NAVAL POSTGRADUATE SCHOOL

MONTEREY, CALIFORNIA

MBA PROFESSIONAL REPORT

A MULTIDIMENSIONAL ANALYSIS OF THE JOINT STRIKE FIGHTER (JSF) ACQUISITION PROGRAM FROM THE PERSPECTIVE OF TURKEY

December 2016

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REPORT DOCUMENTATION PAGE			*Form Approved OMB No. 0704-0188*
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instruction, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188) Washington DC 20503.			
1. AGENCY USE ONLY ***(Leave blank)***	**2. REPORT DATE** December 2016	**3. REPORT TYPE AND DATES COVERED** MBA professional report	
4. TITLE AND SUBTITLE A MULTIDIMENSIONAL ANALYSIS OF THE JOINT STRIKE FIGHTER (JSF) ACQUISITION PROGRAM FROM THE PERSPECTIVE OF TURKEY			**5. FUNDING NUMBERS**
6. AUTHOR(S) Asım Furkan Demir			
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Postgraduate School Monterey, CA 93943-5000			**8. PERFORMING ORGANIZATION REPORT NUMBER**
9. SPONSORING /MONITORING AGENCY NAME(S) AND ADDRESS(ES) N/A			**10. SPONSORING / MONITORING AGENCY REPORT NUMBER**
11. SUPPLEMENTARY NOTES The views expressed in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government. IRB number ____N/A____.			
12a. DISTRIBUTION / AVAILABILITY STATEMENT Approved for public release. Distribution is unlimited.			**12b. DISTRIBUTION CODE** A

13. ABSTRACT (maximum 200 words)

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14. SUBJECT TERMS Joint Strike Fighter, JSF, Eurofighter, acquisition, Turkey, conceptual models, rational actor, organizational behavior, governmental politics			**15. NUMBER OF PAGES** 103
			16. PRICE CODE
17. SECURITY CLASSIFICATION OF REPORT Unclassified	**18. SECURITY CLASSIFICATION OF THIS PAGE** Unclassified	**19. SECURITY CLASSIFICATION OF ABSTRACT** Unclassified	**20. LIMITATION OF ABSTRACT** UU

NSN 7540-01-280-5500 Standard Form 298 (Rev. 2-89) Prescribed by ANSI Std. 239-18

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A MULTIDIMENSIONAL ANALYSIS OF THE JOINT STRIKE FIGHTER (JSF) ACQUISITION PROGRAM FROM THE PERSPECTIVE OF TURKEY

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Submitted in partial fulfillment of the requirements for the degree of

MASTER OF BUSINESS ADMINISTRATION

from the

NAVAL POSTGRADUATE SCHOOL
December 2016

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ABSTRACT

The Joint Strike Fighter (JSF) is the largest and the most expensive multinational development and acquisition program in history. The purpose of this MBA project is to analyze the probable rationale behind Turkey's decision to participate in the JSF program using Graham T. Allison's conceptual models for foreign policy analysis. After providing background information, including a brief history of Turkish military aviation history and the JSF program, and reviewing literature that outlines Allison's rational actor, organizational behavior, and governmental politics models, this thesis analyzes Turkey's decision to participate in the JSF program rather than the Eurofighter program. From a rational actor point of view, each program had its own advantages and disadvantages in terms of Turkey's plausible objectives. The organizational behavior model sheds light on the decision from the perspective of an organization's routines, outputs, and culture.

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TABLE OF CONTENTS

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LIST OF FIGURES

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LIST OF TABLES

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LIST OF ACRONYMS AND ABBREVIATIONS

AESA	active electronically-scanned array
AFB	air force base
ALIS	autonomic logistics information system
APUC	average procurement unit cost
ASTOVL	advanced short takeoff and vertical landing
BUP	bottom-up review
CDP	concept demonstration phase
CTOL	conventional takeoff and landing
CV	carrier variant
DAB	defense acquisition board
DARPA	Defense Advanced Research Projects Agency
DIEC	Defence Industry Executive Committee
DOD	Department of Defense
EOTS	electro-optical targeting system
EU	European Union
FMS	foreign military sales
FY	fiscal year
GAO	Government Accountability Office
GE	General Electric
JAST	Joint Advanced Strike Technology
JSF	Joint Strike Fighter
LRIP	low rate initial production
MBA	master of business administration
MOA	memorandum of agreement
MOU	memorandum of understanding
MRF	multi-role fighter
NATO	North Atlantic Treaty Organization
PAUC	program acquisition unit cost
PDR	preliminary design review
PSFD	production, sustainment, and follow-on development

RAM	rational actor model
SDD	system development and demonstration
SOP	standard operating procedure
STOVL	short takeoff and vertical landing
TAI	Turkish Aerospace Industries
TEI	Turkish Engine Industries
TuAF	Turkish Air Force
TUSAG	United States Air Force Group
TUSAS	Türk Uçak Sanayi Anonim Şirketi
U.K.	United Kingdom
U.S.	United States
UDI	Undersecretariat for Defence Industries
USAF	United States Air Force
USD	United States dollar
USMC	United States Marine Corps
USN	United States Navy

ACKNOWLEDGMENTS

First and foremost, I am sincerely grateful to the Turkish Nation, Turkish Armed Forces, and Turkish Air Force for giving me this academic opportunity.

I would like to thank my advisors, Dr. Nicholas Dew and Dr. Mie Augier, for their time, insights, continuous support, motivation, and patience throughout this hard work.

I would like to express my thanks to my academic associate, Dr. Rene Rendon, for being there whenever I needed help.

I would also like to thank to all the faculty of the Graduate School of Business and Public Policy, who turned this academic education into a precious, enjoyable journey.

Last, but not the least, I would like to express my sincerest gratitude to my family, my parents, and my brother, for their unconditional and continuous support and encouragement through hard times; and my selfless wife, Dr. Gülin Boztaş Demir, for her endless support, patience, motivation, and love and devotion to our family.

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I. INTRODUCTION

A. BACKGROUND

The Joint Strike Fighter (JSF) is the largest and the most expensive development and acquisition program in U.S. Department of Defense (DOD) history, with eight cost-sharing participant countries—the United Kingdom (U.K.), Italy, Netherlands, Turkey, Canada, Australia, Denmark, Norway—and a total cost of nearly $400 billion (Sullivan, 2016).

The main objective of the program is to develop and produce the fifth-generation, stealth, multi-role fighter that will replace aging fighter, strike, and ground attack aircrafts for the United States Navy (USN), Air Force (USAF), Marine Corps (USMC), and eight allies (U.S. Government Accountability Office, 2000).

DOD plans to procure 2,457 F-35s in total for its three services (U.S. Government Accountability Office, 2016a). In addition, around 500 aircraft are expected to be delivered to allied nations, which increases the total number to be produced to almost 3,000 aircraft (Lockheed Martin Corporation, 2016). DOD and the program officials anticipate the costs to procure, operate, and maintain the F-35 fleet throughout their lifecycle to be over $1 trillion, a number that will be challenging to afford (U.S. Government Accountability Office, 2016b).

Due to its extensive scope and substantial life cycle costs, the JSF program is one of the most controversial issues in the United States. This issue however, is not that controversial from Turkey’s point of view at the moment. It is mostly because Turkey has only ordered six F-35s, not committed a significant amount of funds from its defense budget, and not experienced operational issues yet. Nevertheless, it is important to analyze Turkey’s involvement in the program in order to have a more comprehensive idea about the debate outside the United States.

B. PURPOSE

The purpose of this research is to analyze Turkey's decision to participate in the JSF program using Graham T. Allison's conceptual models for foreign policy analysis. This study addresses a probable rationale behind Turkey's choice of JSF program to procure fifth-generation fighter aircraft that will replace aging aircrafts. The intent of this research is not to assess the success of the JSF program from Turkey's perspective, but rather to analyze the JSF program using these conceptual frameworks in order to better understand Turkey's decisions about the JSF, and to provide an example of how the frameworks can be used to shed light on weapons system acquisition by U.S. allies.

C. RESEARCH QUESTIONS

This research aims to answer the following questions:

- What are the reasons behind Turkey's participation in the JSF program?
    - How can Graham T. Allison's conceptual models explain Turkey's decision to participate in the JSF program?
        - How do the Allison models help us understand the role of the Turkish Air Force's history and organizational culture in Turkey's decision to participate the JSF program?
        - How should we understand Turkey's decisions on the JSF program through the rational actor model?

D. SCOPE

The scope of this study is limited to foreign policy aspects of the program, especially from Turkey's perspective. This research does not analyze program characteristics that are only related to the United States and does not affect the entire program.

E. METHODOLOGY

This research incorporates a literature review, data collection, and analysis of the JSF program in Turkey using the conceptual models. The data collection for this study is limited to public sources such as government reports, official websites of organizations discussed, journal articles, and unofficial translations of these sources by the author of this report.

F. ORGANIZATION OF STUDY

Chapter I, "Introduction," provides a brief background on the basis of this research, the purpose of the study, the research questions to be addressed, the scope of the project and the methodology to be followed.

Chapter II, "The Path to The Joint Strike Fighter: A Brief History of Turkish Aviation," delivers a background on the history of Turkish aviation from its foundation, during World War II, and after NATO membership.

Chapter III, "History and Current Status of the JSF Program," gives detailed information on how the JSF project was formed, the involved parties, and initial expectations from the program, as well as the current challenges the program faces.

Chapter IV, "Conceptual Models of Graham T. Allison for Foreign Policy Analysis," explains Graham T. Allison's Rational Actor, Organizational Behavior, and Governmental Politics models in detail.

Chapter V, "Analysis of the JSF Program from Turkey's Point of View Using Conceptual Models," includes a thorough analysis of Turkey's involvement in the F-35 program, based on Allison's Rational Actor and Organizational Behavior models.

Chapter VI, "Conclusion and Suggestions for Future Research," provides a summary and potential areas of future research.

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II. THE PATH TO THE JOINT STRIKE FIGHTER: A BRIEF HISTORY OF TURKISH AVIATION

> The future is in the sky. Nations who fail to protect their skies can never be sure of their tomorrows.
>
> —Mustafa Kemal Atatürk
> Founder of the Republic of Turkey

A. FOUNDATION AND EARLY YEARS (1911–1940)

Evliya Celebi, an explorer, wrote in his travelogue called the Seyahatname (*Book of Travel*), that the roots of Turkish Aviation date back to the 1630s when legendary Ottoman aviator Hezârfen Ahmed Çelebi achieved sustained unpowered flight with eagle wings from the very top of the Galata Tower.

The Turkish Air Force (TuAF) celebrated its 100th anniversary in June 2011. The first official Turkish aviation organization was founded in 1911 as the "Aviation Commission," only eight years after the first flight of the Wright Brothers (Turkish Air Force, n.d.b). Turkish aviators, one of the pioneer groups in military aviation, participated in The Balkan War (1913), World War I (1914–1918), and the Turkish War of Independence (1919–1922) (Güvenç & Yanık, 2012).

After modern Turkey was established on October 29, 1923, Mustafa Kemal Atatürk, founding father of the Republic of Turkey, initiated modernization programs and reforms in all aspects of life: agriculture, education, industry, economy, politics, legislation, health, transportation, and more. Atatürk had a special interest for aviation. His foresight and vision were not limited to national security, and his use of the term "sky" was not limited to Stratosphere:

> No doubt, aircrafts are both the most effective weapon and means of the future. One day, humankind will walk in the skies without aircrafts, go to planets and, maybe, send us news from the moon. Waiting for the year 2000 will not be necessary for this miracle to become real. (*Türk Hava Kurumu Tüzüğü* [Turkish Aeronautical Association Statute], 2004)

Advancement in aviation rapidly became a representation of power and development in Turkey. By 1935, ordinary Turkish citizens had raised funds for approximately 250 military aircraft through the Turkish Aircraft Association (Ozdemir, 2009).

The young Turkish Republic, seeking investors, and German Junkers Company, seeking a way to manufacture aircraft around the limitations of the Treaty of Versailles, founded an aircraft plant (Turkish Aircraft, Automobile and Engine Ltd.) in Kayseri in 1925. Unfortunately, this effort resulted in failure. However, in the 1930s, the Kayseri plant continued to be used as the location to assemble the aircraft that were purchased from the United States, the U.K., Germany, and Poland (Ozdemir, 2009).

On the other side, there were individual domestic attempts to design and produce aircraft as well. Out of those, the efforts of Vecihi Hürkuş, a veteran fighter pilot, and Nuri Demirağ, an aviation enthusiast and businessman, are the most renowned ones. Still to this date, Hürkuş (free bird) is recalled as the name of the first Turkish aircraft and the person who built the first Turkish aircraft (Güvenç & Yanık, 2012).

B. WORLD WAR II (1940–1950)

Between the two World Wars, Turkey chose not to be dependent on a single source for aircraft. For instance, Turkish government purchased bombers and trainers from the United States, the U.K. and Germany, while Poland provided the fighters. This trend changed right before World War II. In 1939, a treaty of alliance was signed between Turkey, France, and the U.K., a month after Germany attacked Poland. The treaty mandated military assistance to Turkey from France and the U.K., including military aircraft. Turkish air service started to improve with British guidance using U.S. lend-lease aircraft. Turkish officers were also sent over to the U.K. for further flight training.

The Turkish Air League constructed another plant in Etimesgut, Ankara, with the purpose of assembling Miles Magister trainers and British Gypsy engines. The end product of the plant was a derivative of the Miles Magister and had clipped wings, uprated engine, and an enclosed cockpit. The aircraft was named MKEK-4 Uğur, and 60

of them were produced in 1954 to meet the basic training requirements of the TuAF. Until the 1980s, the Uğur was the last aircraft to be assembled in Turkey (Güvenç & Yanık, 2012).

Turkey started to receive military assistance from the United States under the Truman Doctrine, two years after World War II. This assistance is largely believed to have helped Turkey form and improve an air force separate from the army, before the Cold War. The United States Air Force Group (TUSAFG), an advisory board to modernize the Turkish Air Force, not only introduced U.S. Air Force (USAF) equipment, construction and training to TuAF, but also suggested an organizational structure similar to the U.S. DOD. In May 1949, the Turkish Parliament passed a law to reform the Turkish defense department based on the U.S. model (Livingston, 1994).

The U.S. military aid provided a tremendous improvement for the TuAF aircraft inventory. On the other side, the fledgling Turkish aviation industry became redundant with their moderate production capacity and somewhat advanced aircraft design and did not stand a chance against high-numbered low-priced military aid aircraft (Güvenç & Yanık, 2012).

C. NATO MEMBERSHIP AND BEYOND

In spite of initial hesitancy from countries outside of the North Atlantic region, on February 15, 1952, Turkey was officially accepted into the North Atlantic Treaty Organization (NATO). Turkey's persistent diplomacy, geopolitical location as an "unsinkable aircraft carrier," and excellent performance in Korea played a critical role in the process (Livingston, 1994). Soon after that, in October 1953, TuAF was appointed by the Brussels headquarters to the command of the Sixth Allied Tactical Air Force located in Izmir (Livingston, 1994).

With the delivery of F-84G Thunderjets in 1952, not only the transition of Turkish Air Force to jet aircraft, but also the reign of the US Air Force jet combat aircraft began. The TuAF entirely operated aircraft that were designed and produced for the USAF. The average lag time between an aircraft's entering U.S. service and TuAF's procurement of that aircraft (see Table 1) was reported as 6.9 years (Karaağaç, 2010).

Table 1. Jet Aircraft Operated by Turkish Air Force and Their Start Service Dates. Adapted from Karaağaç (2010).

Generation	Aircraft	Start Service in USAF	Start Service in TuAF	Difference
1	F-84G Thunderjet	1947	1952	5
	F-86 Sabre	1949	1954	5
2	F-100 Super Sabre	1954	1958	4
	F-102 Delta Dagger	1956	1968	12
	F-104 Starfighter	1958	1963	5
3	F-4 Phantom	1960	1974	14
	F-5 Freedom Fighter	1962	1965	3
4	F-16 Fighting Falcon	1980	1987	7

TuAF refrained from operating non-USAF aircraft, especially due to the logistics system. For example, in 1961 Turkey refused to acquire Italian-built G-91R lightweight strike aircraft, simply because they did not want to interfere with the current logistics system. On the other hand, Turkey did not want to accept all USAF-operated aircraft either. TuAF rather preferred multi-role fighter-bomber type aircraft; thus, in 1961 they refused to acquire USAF-operated mission specialized combat aircraft such as interceptors like the F-86E and F102A. As an example of a combination of both, in 1984, Turkey turned down 40 British Tornado aircraft, since the aircraft were non-USAF and were designed to interdict and strike only (Güvenç & Yanık, 2012).

Receiving aircraft from a single source had its advantages in terms of continuity and standardization; however, this also led to a clear disadvantage in terms of serious military and diplomatic dependence. In early the 1970s, the results of this U.S. dependence started to surface (Güvenç & Yanık, 2012). Especially during the détente (between 1967 and 1979), Turkey came to realize the importance of military independence when issues with Cyprus presented themselves (Güvenç & Yanık, 2012).

To regain independence, a quick fix was to diversify in terms of aircraft suppliers. A more radical solution was to start a national aircraft industry. Due to limitations in budget, the decision makers needed to reuse a model that had been successfully executed during the interwar years. In order to raise money for a national aircraft industry, Hava

Kuvvetlerini Güçlendirme Vakfı (Foundation for Strengthening the Air Force) was founded in 1970. Individuals and institutions were asked to contribute financially. With the motto ‘build your own aircraft,’ the foundation aimed to stimulate enthusiasm and air-nationalism. By 1973, the foundation was able to gather enough funds to establish Türk Uçak Sanayi Anonim Şirketi (TUSAŞ).

When Turkey conducted a military intervention in Cyprus in July 1974, the importance of the air forces was realized once again. However, this move led to a U.S. embargo on arms to Turkey. The embargo got the U.S. Congress involved in U.S. arms transfer decisions. As a result, the Congress has remained a participant in future decisions regarding arms deals between Turkey and the United States.

During the embargo, TUSAŞ awarded a contract to the Italian company Aermacchi, to build MB 339 Trainer/Close Air Support Aircraft in 1977. The following year, the embargo was lifted, and the United States immediately tried to supply T-38A Talon advanced trainers, causing the MB 339 contract to be annulled (Güvenç & Yanık, 2012).

The Turkish government decided to produce 270 (then 160) combat aircraft in Turkey and was looking for partners to perform that production. General Dynamics and McDonnell Douglas, both from the United States, offered to co-produce the F-16 Fighting Falcon (USAF-operated) and the F/A-18 Hornet (Naval aircraft), respectively. In 1983, Turkey decided to go forward with the single-engine F-16C/D aircraft, which cost significantly less than the twin-engine Hornet. Later on, the F-16 aircraft improved TuAF’s operational capabilities, satisfying Turkey’s power requirements, proving it was the right decision to opt for a multi-role combat aircraft (Güvenç & Yanık, 2012).

In 1984, Turkish Aerospace Industries (TAI) was established as a joint venture between TUSAŞ, holding 51 percent of the shares, and General Dynamics, which was later acquired by Lockheed Martin Corporation (Turkish Aerospace Industries, n.d.c). In 2005, Turkish shareholders purchased “foreign shares” (remaining 49 percent) belonging to Lockheed Martin’s shares and General Electric (GE) (Turkish Aerospace Industries, n.d.c). TAI assembled almost all the F-16s ordered by TuAF. Another joint

venture, Turkish Engine Industries (TEI), between TUSAS and GE was established to produce F-110GE turbofan engines for the Turkish F-16s (Güvenç & Yanık, 2012). Between 1987 and 2012, TAI assembled and delivered a total number of 308 F-16s (Turkish Aerospace Industries, 2012). To date, TAI and TEI are still leaders of Turkish aviation industry.

D. TURKISH PARTICIPATION IN THE JSF PROGRAM

In 1999, in order to replace TuAF's aging F-4 and F-16 fleets with a next generation fighter, Turkey joined the JSF program's Concept Demonstration Phase (CDP) as a Foreign Military Sales (FMS) Major Participant. In 2002, Turkey signed the international Memorandum of Understanding (MOU) for the System Development and Demonstration (SDD) Phase as a level III partner. On December 12, 2006, the Turkish Defence Industry Executive Committee (DIEC) selected the JSF as the future combat aircraft of TuAF and signed the MOU for the Production, Sustainment, and Follow-on Development (PSFD) Phase on January 25, 2007 (Undersecretariat for Defence Industries, 2016).

As of August 2016, Turkey plans to buy 100 F-35As and ordered six F-35As (two in Low Rate Initial Production (LRIP)-10 and four in LRIP-11) (Undersecretariat for Defence Industries, 2016).

III. HISTORY AND CURRENT STATUS OF THE JSF PROGRAM

A. FORMATION OF THE JSF PROGRAM

In the aftermath of the dissolution of Soviet Union, in 1993, the U.S. DOD, under the Clinton Administration, conducted an inclusive review, called the bottom-up review (BUP), to refine the nation's defense strategy, modernization plans, and force structure. One of the important decisions in the BUP was to terminate the A/F-X (a replacement program for carrier-based A-6 attack aircraft of the Navy) and Multi-Role Fighter (MRF) (a replacement program for F-16s) programs.

1. Joint Advanced Strike Technology Program

The second key decision of the review was to launch the Joint Advanced Strike Technology (JAST) program as a substitute for the terminated programs in order to develop several prototype aircraft to discover new technologies for common use with future aircraft. The purpose of the program was to reduce the development and production costs by developing a joint design whose components would be shared by future aircraft up to 80 percent in terms of cost (U.S. Department of Defense, 1993).

In January 1994, following the program office establishment, the JAST program started conceptual design studies to determine a technology development program with Lockheed Martin, Boeing, Pratt and Whitney, and McDonnell Douglas. The studies did not aim to perform flight demonstration of a certain aircraft design. Afterwards, the program narrowed its focus to developing an aircraft family that would replace some of the aging U.K. and U.S. aircraft (Bolkcom, 2003).

In 1995, another program was included in the JAST program as a result of a congressional direction. This new program aimed to develop an advanced short takeoff and vertical landing (ASTOVL) aircraft and was directed by the Defense Advanced Research Projects Agency (DARPA). The new aircraft attracted attention and enabled the participation of the USMC and U.K., both of whom were already interested in obtaining new short takeoff and vertical landing aircrafts (STOVL) to replace their aging Harrier

STOVL aircraft. Following the addition of the USMC and the U.K., the program name JAST became Joint Strike Fighter, or JSF. The program also became more concentrated on developing and producing next-generation attack aircraft in a united, collaborative manner (Bolkcom, 2003).

2. The Joint Strike Fighter Program

Lockheed Martin, Boeing, and McDonnell Douglas (together with British Aerospace and Northrop Grumman) presented three different designs for the airframe. The DOD decided and announced on November 16, 1996, that Lockheed Martin and Boeing would compete in the Concept Demonstration phase of the program. Additionally, Pratt and Whitney was given the task of delivering support for propulsion hardware and engineering. Following that, contracts were awarded to both Lockheed Martin and Boeing for building and testing two prototypes (Gertler, 2014).

It was very important for DOD to carefully scrutinize the designs of both Lockheed Martin and Boeing, as their final decision was anticipated to affect the coming years of U.S. military aviation as well as the U.S. combat aircraft industrial base. After all, the JSF program was expected to be the final fighter aircraft program to be conducted by DOD for a considerably long time, regarding the program's size and foreseen outcome (Gertler, 2014).

In March 2000, a Joint Operational Requirements Document was released, and in October 2001, the document was revalidated by DOD's Joint Requirements Oversight Council. The Defense Acquisition Board conducted a Milestone B review on October 24, 2001, which would permit the program to continue with the SDD phase. The next day, the Secretary of Defense reported to Congress that the program had completed the Concept Development Phase exit criteria and could move on to the SDD phase (Gertler, 2014).

Lockheed Martin and Pratt and Whitney were awarded SDD contracts on October 26, 2001. In addition, General Electric stayed responsible for technical support regarding the development of an alternate engine to compete at the production phase (Gertler, 2014).

3. F-35 Lightning II

The design that won the SDD contract was the X-35, and the F-35 Lightning II (see Figure 1) was derived from that design.

Figure 1. F-35 Lightning II Logo. Source: SF Program Office (n.d.a).

As a tribute to Lockheed's World War II-era twin-propeller Lockheed P-38 Lightning (United States Army Air Forces) and the Cold War-era jet English Electric Lightning (Royal Air Force), on July 7, 2006, USAF, as the main customer, declared that the aircraft would be named “F-35: Lightning II” (Lockheed Martin Corporation, 2014).

To meet requirements, the F-35 is designed to have three variants which are quite similar, yet different: F-35A, F-35B, and F-35C. In April 2003, a Preliminary Design Review (PDR) was performed on the F-35 program. Critical Design Reviews for the F-35A and F-35B took place in February 2006, and another one in June 2007 for the F-35C. Further details about the aircraft and its variants are given in the next section.

B. INTERNATIONAL PARTICIPATION IN JSF PROGRAM

The JSF program is an international acquisition program to which participating nations are expected to contribute financially and technologically. The program also aims to bring governments together on an advanced coalition platform in terms of military services. Therefore, the F-35 aircraft not only provides novel technologies to the partners’

air forces but also makes international cooperation possible (U.S. Department of Defense, 2003).

In terms of cooperation, the program does not merely bring the ally governments together, it also allows prime contractors and industrial partners to get involved. The MOU framework set up a structure for the relationship of the participating governments, defining the role of each partner, as well as their responsibilities and what they should expect as an outcome of the program. In addition, the relationship between the prime contractor and the subcontractors was established by certain licenses and agreements (U.S. Government Accountability Office, 2003).

In accordance with the financial contribution of each country, the program's international participation has been divided into three levels. For instance, being a level 1 partner meant 10 percent financial contribution to develop the aircraft. In return, the partner is provided fully-involved staff in office as well as a director-level national deputy. The more money the country paid meant the more that country would be involved in the decisions on the requirements and the design of the aircraft, and would have broader access to the developing technologies (O'Rourke, 2009a).

1. Concept Demonstration Phase

The JSF program differed from most DOD acquisition programs by having noteworthy foreign involvement at early stages of the design phase. It was favorable to have foreign governments and industries as participants in order to boost equipment interoperability among ally nations as well as to have access to technologies of the allies. In return, this arrangement allowed the United States to share its capabilities with allies, as well as to divide financial aspects of the program and to support foreign acquisition of the aircraft.

The four official foreign government participation levels during the CDP are as follows:

(1) Full Collaborative Partner

During the CDP, the program's sole collaborative partner was Britain. In 1995, Royal Navy became a participant of the program with an MOU. Then in 1999, the Royal Air Force was added to the memorandum. The U.K. was not only providing $200 million to the CDP but also playing an active role in determining of program requirements (Birkler et al., 2001). The MOU aimed to boost the coordination between U.S. services' and U.K. systems' requirements. In addition, on a number of integrated product teams, U.K. personnel were also included. A National Deputy at the director level was not the only position held by the U.K., but towards the end of the CDP, the U.K. had eight country representatives at the Program Office (Birkler et al., 2001).

(2) Associate Partner

The three countries that are at the associate partner level are the Netherlands, Norway, and Denmark. Within the year of 1997, each of these countries signed previously negotiated agreements. Their financial contribution was $10 million each, making $30 million in total, which was equal to U.S. contribution, bringing the total to $60 million. The associate partners aimed to be effective in requirements process of CTOL variant. Regarding both the MOU and the Memorandum of Agreement (MOA), the associate partners had the opportunity to have a say in the requirements development as long as the United States agreed that the outcomes would be beneficial for both parties. In the CDP, the associate partners each had one national deputy and one technical representative (Birkler et al., 2001).

(3) Informed Partner

The informed partners of the project were Italy and Canada. An MOU was signed between the United States and Canada in January 1998 and an MOA was signed between the United States and Italy in December 1998. Unlike full collaborative and associate partners, the informed partners were not provided with the authority to influence the requirements. The Italian Navy and Italian Air Force were involved in several tasks regarding the STOVL and the CTOL variants of the aircraft, respectively. On the other hand, Canada was involved in design improvements of the CTOL variant, in addition to

some other related tasks. Both countries provided $10 million each, and the United States contributed $50 million to the joint U.S.-Canadian activities (Birkler et al., 2001).

(4) Foreign Military Sales Major Participant

In 1999, Turkey, Singapore and Israel signed Letters of Offer and Acceptance and became FMS major participants (Birkler et al., 2001). These participants were included in the basic aspects of the JSF program, and were provided with access to unclassified and nonproprietary information regarding the designs and the requirements. Turkey contributed $6.2 million, whereas Singapore provided $3.6 million, and Israel contributed $0.75 million (Birkler et al., 2001). Unlike for the previous participant efforts, the United States is not financially contributing to joint FMS major participant efforts.

Table 2 summarizes participant countries and their contributions to the program in the CDP.

Table 2. International Participation in JSF CDP. Source: Birkler et al. (2001).

Country	Status	Agreement	Foreign contributions	U.S. contributions	Date joined
United Kingdom	Full Partner	MoU	$200M	—	Dec 95
Netherlands	Associate Partner	MoA	$10M	$10M	Apr 97
Norway	Associate Partner	MoU	$10M	$10M	Apr 97
Denmark	Associate Partner	MoU	$10M	$10M	Sept 97
Canada	Informed Partner	MoU	$10M	$50M	Jan 98
Italy	Informed Partner	MoA	$10M	—	Dec 98
Singapore	Major Participant	LOA	$3.6M	—	Mar 99
Turkey	Major Participant	LOA	$6.2M	—	Jun 99
Israel	Major Participant	LOA	$0.75M	—	Sep 99

2. System Development and Demonstration Phase

Between 2001 and 2002, the U.K., Italy, Netherlands, Turkey, Australia, Norway, Denmark, and Canada joined the SDD phase. Based on the amount they financially contributed, the foreign participant nations were assigned to one of three levels during the SDD phase. Each participant receives benefits in proportion to their financial contributions (Table 3) (Bolkcom & Murch, 2007). Additionally, their level also defines the number of representatives they have in the program office, the degree to which they have access to data and technological information, and whether or not they are members of management decision-making bodies (U.S. Government Accountability Office, 2006).

The JSF program does not promise the domestic or foreign suppliers a certain level of work in line with the participants' financial contribution, which is what usually was observed in other international cooperative projects. The JSF program lets the suppliers bid for the work, which is a system termed as the "best value" by the DOD and the program office (U.S. Government Accountability Office, 2006).

Partnership levels in the SDD phase are as follows (and summarized by country in Table 3):

(1) Level I

The only Level I country in the SDD phase is the U.K. with its $2 billion contribution. On January 17, 2001, the United States and the U.K. agreed on the U.K.'s involvement in the SDD phase, which made up 8 percent of the whole SDD phase (Bolkcom & Murch, 2007). Although the prime contractor had yet to be determined, proponents called the U.K.'s involvement a "strong international affirmation of the JSF concept." Numerous U.K. firms are participating in the program including Rolls-Royce and British Aerospace (Bolkcom & Murch, 2007).

(2) Level II

Level II countries are Italy and the Netherlands. While Italy is contributing $1 billion, the Netherlands is contributing $800 million to the program at this phase (Bolkcom & Murch, 2007). Italy's main reason to join the program was to replace its leased U.S. F-16 aircraft and complement their Eurofighter Typhoons. They became a senior Level II partner of the program and now hold five positions in the Joint Program Office. Italy wanted its own final assembly line as well as a maintenance and upgrade facility. On the other hand, the Netherlands was integrated into the program on June 17, 2002, following an evaluation of the potential alternatives on their side for a period of 30 months. The Netherlands has aimed to enhance its position as a center of overhaul, maintenance, and repair in Europe (Bolkcom & Murch, 2007).

(3) Level III

The rest of the participating nations, Canada, Norway, Denmark, Australia, and Turkey, became Level III partners of the program with financial contributions ranging between $100 and $175 million (Bolkcom & Murch, 2007). Although in terms of money Level III partners' contributions are significantly less than the Level I and II partners, the United States is committed to provide all the partners with the aircraft once produced. Turkey's involvement in the program was considered as a good opportunity for Turkish defense industry by Turkish officials (Bolkcom & Murch, 2007).

Table 3. JSF Partner Financial Contributions in the SDD Phase. Source: Ozdemir (2009).

Partner country	**System development and demonstration**		
	Partner level	**Financial contributions (in millions)**	**Percentage of total costs**
United Kingdom	Level I	$2,056	4.96
Italy	Level II	$1,028	2.48
Netherlands	Level II	$800	1.93
Turkey	Level III	$175	0.42
Australia	Level III	$144	0.33
Norway	Level III	$122	0.29
Denmark	Level III	$110	0.27
Canada	Level III	$100	0.24
Partners		**$4,535**	**10.93**
United States		$36,946	89.07
Total		**$41,481**	**100.0**

3. Production, Sustainment, and Follow-On Development Phase

Unlike the SDD phase, the PSFD phase does not name any partner levels. The PSFD MOU includes the reasons why the participants are interested in purchasing the new aircraft, which variant, in what quantity, and the delivery schedule. The program structure is expanded to involve the partners in the decision of follow-on development. This phase's costs are divided among the participants in proportion to each partner's planned purchase amount (Bolkcom & Murch, 2007).

In addition, the PSFD is an agreement that includes all participating nations and is not bilateral like the SDD MOUs. According to the program executives, it was harder to reach an agreement among all participants, due to the expectancy of "offset" arrangements in the PSFD agreement. In the case of defense contracts involving foreign partners, offset arrangements are viewed as standard. These arrangements are generally supported by certain actions in order to balance the agreement's effect on the purchasing nation's local workforce. For the JSF program, however, the executives wanted to avoid offsets and encourage competition instead. Therefore, all participating nations agreed to a competitive work environment and to follow a "best-value" basis for the PSFD MOU (Bolkcom & Murch, 2007).

4. Primary Reasons and Concerns of Partner Countries to Participate in the JSF Program

According to a U.S. DOD study (U.S. Department of Defense, 2003), participant countries had two primary motives for participating in the JSF program: operational requirement and industrial benefit. Table 4 summarizes the primary motives, government approaches, and concerns of participant countries in the SDD phase.

Table 4. Summary of Country Strategies and Concerns.
Source: Ozdemir (2009).

Countries	Primary Motive behind SDD Participation	Major Key to Government Approach to JSF Program	Main Concerns with JSF Program
United Kingdom	Operational requirement	Early commitment to JSF Program	Delayed information disclosure
Italy	Operational requirement	Worked with Lockheed Martin to develop industry support	US contracting practices unfamiliar, Lengthy TAA approvals
Netherlands	Industrial benefit	"Public - Private Partnership"	US sub-tiers unwilling to source work to global suppliers, Lengthy TAA approvals
Canada	Industrial benefit	Pro-active "JSF Canada" organization	"Strategic Sourcing"
Norway	Industrial benefit	Teaming with other partner countries to increase competitiveness	US top tier contractors favor established suppliers
Denmark	Operational requirement	Liaison between Danish industry and Lockheed Martin and sub-contractors	Large companies often absorb upfront development costs
Australia	Operational requirement	Government liaison between Australian industry and program IPTs	Export regulations - TAAs and GPA
Turkey	Industrial benefit	MOD liaison between industry and Lockheed Martin	Lack of communication

C. SPECIFICATIONS OF F-35 JOINT STRIKE FIGHTER

In this section, description of the participant's requirements, three variants of F-35 and common technological characteristics of the JSF are specified.

1. Description of the Requirement

According to JSF Program Office (n.d.c), the participants of the JSF program have different necessities that the aircraft to be produced is expected to satisfy. For instance, the USN requires a first day of war, survivable strike fighter aircraft, whereas the USAF is in need of a multirole aircraft (Primary-air-to-ground). On the other hand, the USMC and the U.K. are looking for a STOVL aircraft and other nations demand a CTOL aircraft (JSF Program Office, n.d.c).

2. Variants of F-35

Although the general design of the F-35, produced by Lockheed Martin with its partners Northrop Grumman and BAE systems, is similar to a scaled-down F-22, the variants of the F-35 aircraft are developed in order to fulfill the individual needs of the participants: The F-35A is designed for the USAF; the F-35B is for the USMC and the U.K.; and the F-35C is for the USN. Despite having nuances (see Figure 2), the variants are united in terms of airframe, avionics components, and engine specifications in order to keep the costs of development, production, operation, and support at a moderate level (JSF Program Office, n.d.c).

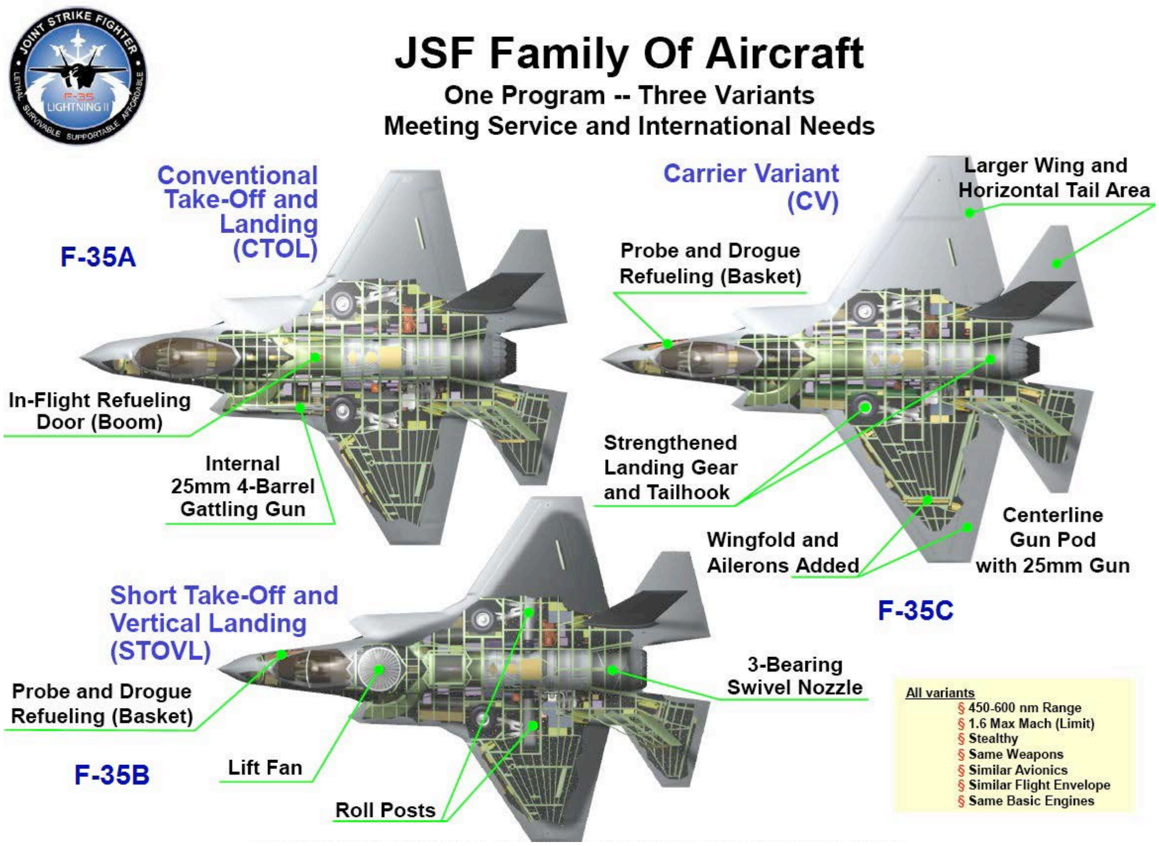

Figure 2. Three Variants of F-35. Source: Defense Industry Daily (2015).

a. F-35A Conventional Takeoff and Landing

The F-35A is built for the U.S. Air Force and participant allies making it the most prevalent variant of the F-35 Lightning II (Figure 3). Having the capability of conventional takeoff and landing, the F-35A is most suitable for traditional bases and regular runways; thus, it is the primary export variant for the allied nations, including Turkey. It is an agile, high-performance, 9g capable stealth multirole fighter that takes advantage of sensor fusion and unprecedented situational awareness. Only the F-35A variant has an internal cannon. It utilizes the flying boom method for air-to-air refueling (Lockheed Martin Corporation, n.d.a).

Figure 3. F-35A Conventional Takeoff and Landing (CTOL). Source: JSF Program Office (n.d.b).

b. F-35B Short Takeoff/Vertical Landing

The F-35B aircraft is unique in terms of combining stealth, STOVL capability, and supersonic speed, meaning that this certain aircraft is capable of operating from roads and austere bases, as well as small, air-capable ships near front-line combat zones, in addition to longer runways on major bases where it can conventionally takeoff and land (see Figure 4). Moreover, the ability to deploy close to front-line combat zones allows shortening the distance from base to target, hence reducing the logistics support requirements and increasing sortie frequencies (Ozdemir, 2009).

Figure 4. F-35B Short Takeoff/Vertical Landing (STOVL). Source: JSF Program Office (n.d.b).

A shaft-driven propulsion system (LiftFan by Rolls-Royce) and an engine, capable of rotating 90 degrees, enabled F-35B to perform the STOVL function. With respect to F-35A, the F-35B has a smaller internal weapon bay and a smaller internal fuel capacity due to the LiftFan. Finally, the variant uses the probe and drogue method for aerial refueling, instead of the F-35A's boom method (Lockheed Martin Corporation, n.d.b).

On July 31, 2015, it was announced that 10 F-35Bs were ready for deployment, which meant the USMC's aircraft had achieved initial operational capability (U.S. Department of Defense, 2015).

The USMC and the U.K. received their F-35B aircraft. The aircraft are placed at Marine Corps Air Station at Yuma, Arizona, which is the first operational F-35B base, and the Marine Corps Air Station at Beaufort, South Carolina, in which the trainings for the aircraft will be carried out. For the operational testing of the first F-35Bs of the U.K.

are at RAF 17 Squadron in Edwards Air Force Base (AFB), California. The F-35B will be used by the Italian Air Force as well (Lockheed Martin Corporation, n.d.b).

c. The F-35C Carrier Variant

The F-35C carrier variant is the USN's first stealth aircraft (see Figure 5). The variant is capable of catapult launching from large carriers and fly-in arrestments. The pilot will be able to operate the aircraft precisely at carrier approaches thanks to the larger wings and control surfaces. The variant also has added wingtip ailerons that can fold; thus, the aircraft occupies less space on the carrier's deck. Moreover, the aircraft is able to endure the launches and recoveries from the carrier due to the larger and more robust landing gear and stronger internal structure. Additionally, to reduce the need for maintenance to protect the very low observable radar signature of the aircraft, ruggedized materials are used for the exterior (Lockheed Martin Corporation, n.d.c).

Figure 5. F-35C Carrier Variant. Source: JSF Program Office (n.d.b).

Among all three variants, the F-35C has the largest internal fuel capacity at approximately 20,000 lbs. The greater capacity allows the aircraft to loiter longer at greater range than the other F-35 variants, which makes it possible for the Navy to control the aircraft from a distance without interference. The F-35C uses the probe and drogue method for refueling like the F-35B variant (Lockheed Martin Corporation, n.d.c).

3. Technological Characteristics of F-35

Common key technological characteristics among all variants are the following:

(1) Electronic Attack

F-35 pilots will be able to detect and follow the enemy, disrupt attacks, and jam radars very efficiently due to advanced electronic warfare features of the aircraft. In addition, the pilots will always be one step ahead by having real-time access to battle space information with 360-degree coverage thanks to advanced avionics (Lockheed Martin Corporation, n.d.d). The sensors on the aircraft will be able to gather data and instantly share them with the commanders. The pilots will be able to suppress enemy radars and engage highly-defended targets (Lockheed Martin Corporation, n.d.d).

(2) Air-to-Surface

The F-35 aircraft is capable of evading radars, which fourth-generation aircraft cannot, thanks to its very low-observable stealth. According to Lockheed Martin Corporation (n.d.d), together with active electronically-scanned array (AESA) radar technology and “clean configuration,” the ability to carry internal weapon loads, and fuel tank, the F-35 can last longer in action, avoiding being detected. To fulfill an air-to-ground mission, the aircraft can use air-to-air radar-guided missiles and precision-guided munitions. With this type of structure and advanced technological features, the aircraft will have a clear advantage against its opponents (Lockheed Martin Corporation, n.d.d).

(3) Air-to-Air

In addition to its information systems and integrated sensors, F-35 has a smaller radar cross-section compared to fourth-generation and legacy aircraft, which provides significant advantage to detect foes first and take lethal action from a greater distance

without being detected. It is an ability that will change air-to-air tactics of the previous generation completely (Lockheed Martin Corporation, n.d.d).

(4) Intelligence, Surveillance, and Reconnaissance

The processor speed of 400 billion operations per second of its core processor, combined with stealth and integrated sensors, allows the F-35 to gather and process an unprecedented amount of data and share this real-time data securely with all commanders in the battlefield. To carry out intelligence, surveillance, and reconnaissance missions, the F-35 has an electronic warfare suit and Electro-Optical Targeting System (EOTS) consisting of eight sensors, which provide 360-degree coverage to identify electronic emissions and enemy radars (Lockheed Martin Corporation, n.d.d).

(5) Unparalleled Stealth

Enemy radars virtually cannot detect the F-35 due to its unprecedented stealth capability provided by its advanced materials, axisymmetric nozzle and integrated airframe design, and extensive countermeasures (Lockheed Martin Corporation, n.d.d).

(6) Interoperability

The F-35 raises situational awareness of the entire network of operation centers and legacy aircraft by sharing all data gathered from the battlefield information (Lockheed Martin Corporation, n.d.d). Modern tactical datalinks, beyond line-of-sight communications, and web-enabled logistics support will provide the F-35 a high level of interoperability among the coalition forces (Ozdemir, 2009).

(7) Full Mission Systems Coverage

Avionics, communication systems, displays, and integrated electronic sensors are together known as mission systems. The mission systems are responsible for gathering and sharing data with the pilot and friendly aircraft at sea/on the ground. The F-35 aircraft is equipped with the most advanced versions of these components related to communication, such as the AESA radar, helmet mounted display, distributed aperture system, EOTS targeting system, and the communications, navigation, and identification avionics (Lockheed Martin Corporation, n.d.d).

D. COST AND SCHEDULE OVERRUNS

In October 2001, the Defense Acquisition Board (DAB) approved Milestone B, and the SDD contract was awarded to Lockheed Martin. Regarding the Milestone B decision of the DAB, the Cost Analysis Improvement Group made an independent cost estimate and evaluated the program as highly risky considering both the schedule and performance aspects. They found the schedule, driven by the urgent need to replace aging aircraft, too ambitious with the intention of having the first flight in 2005 and producing 600 aircraft by the end of the initial operational test and evaluation in March 2012. The concurrency of this schedule was 25 percent, whereas it was 18 percent for the F-22 program, which was similarly demanding resources (Blickstein et al., 2011).

DOD initiated the program in October 2001 anyway, which at the time had noteworthy scheduling issues in terms of development and production. In 2004, when problems regarding performance started to surface, the program was reviewed and rearranged. Then, in 2007, the baseline was reformed once again because of the increasing cost and scheduling slips. The whole program was restructured due to continuing issues by the Secretary of Defense in February 2010 (U.S. Government Accountability Office, 2012). The growth occurred in two big jumps that can be observed in Figure 6.

When the Program Acquisition Unit Cost (PAUC) and Average Procurement Unit Cost (APUC) were evaluated in December 2010, for baselines for the year 2001 and 2007, a serious Nunn-McCurdy breach was observed due to cost and schedule issues. At the end of 2010, the breach for the PAUC was 78.23 percent and 80.66 percent for the APUC with respect to the 2001 baseline, and was 27.34 percent for the PAUC and 31.23 percent for the APUC with respect to the 2007 baseline (Blickstein et al., 2011).

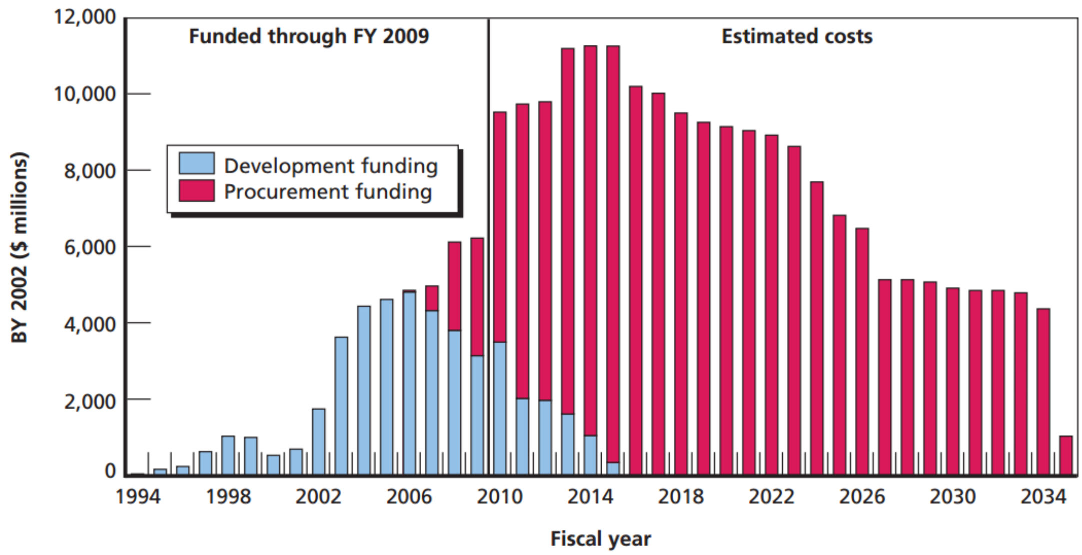

Figure 6. F-35 Acquisition Funding. Source: Blickstein et al. (2011).

In March 2012, DOD implemented a new acquisition program baseline, which was a decision that was made two years after Congress was informed about the critical Nunn-McCurdy breach and cost/schedule issues and the need to determine a new milestone approval and new baseline. The new baseline foresaw the total acquisition cost as $395.7 billion, which was of $117.2 billion more than 2007 baseline, including $335.7 billion in procurement funding, an increase of $104 billion from the 2007 baseline (see Figure 7) (U.S. Government Accountability Office, 2012).

	October 2001 (system development start)	December 2003 (2004 replan)	March 2007 (approved baseline)	June 2010 (Nunn-McCurdy)	March 2012 (approved baseline)
Expected quantities					
Development quantities	14	14	15	14	14
Procurement quantities (U.S. only)	2,852	2,443	2,443	2,443	2,443
Total quantities	2,866	2,457	2,458	2,457	2,457
Cost estimates (then-year dollars in billions)					
Development	$34.4	$44.8	$44.8	$51.8	$55.2
Procurement	196.6	199.8	231.7	325.1	335.7
Military construction	2.0	0.2	2.0	5.6	4.8
Total program acquisition	$233.0	$244.8	$278.5	$382.5	$395.7
Unit cost estimates (then-year dollars in millions)					
Program acquisition	$81	$100	$113	$156	$161
Average procurement	69	82	95	133	137
Estimated delivery and production dates					
First production aircraft delivery	2008	2009	2010	2010	2011
Initial operational capability	2010-2012	2012-2013	2012-2015	TBD	TBD
Full-rate production	2012	2013	2013	2016	2019

Figure 7. JSF Program Cost and Quantity Estimates over Time. Source: U.S. Government Accountability Office (2012).

With the new baseline, the quantity of the total JSF procurement through fiscal year (FY) 2017 was cut by 410 aircraft. However, DOD expects to meet the predetermined procurement of 2,443 jets for the United States and anticipates for the costs to expand beyond FY 2017 (U.S. Government Accountability Office, 2012). The changes in procurement quantities can be seen in Figure 8.

In June 2014, the whole F-35 fleet was banned from flying for a month after an F-35A engine caught fire at takeoff. Flight restrictions were also issued for the following couple months. Pratt and Whitney conducted an investigation to determine the cause, and reported that the incident occurred due to excessive heating as a result of engine fan components rubbing onto each other and causing the engine parts to be released at high speed. As the fleet was grounded and then the flights were restricted for a certain period of time, none of the preplanned flight tests were conducted. However, some tests that were scheduled to be done later were possible to accomplish instead; thus, the overall schedule was still manageable. Regarding the overheating problem, further investigations were carried out. The contractor detected 22 other engines with the same problem. A short-term solution was offered by the officials to resume flight test operations. Eighteen

of those 22 aircraft were fixed with this solution and were back to regular flight operations by January 31, 2015 (U.S. Government Accountability Office, 2015).

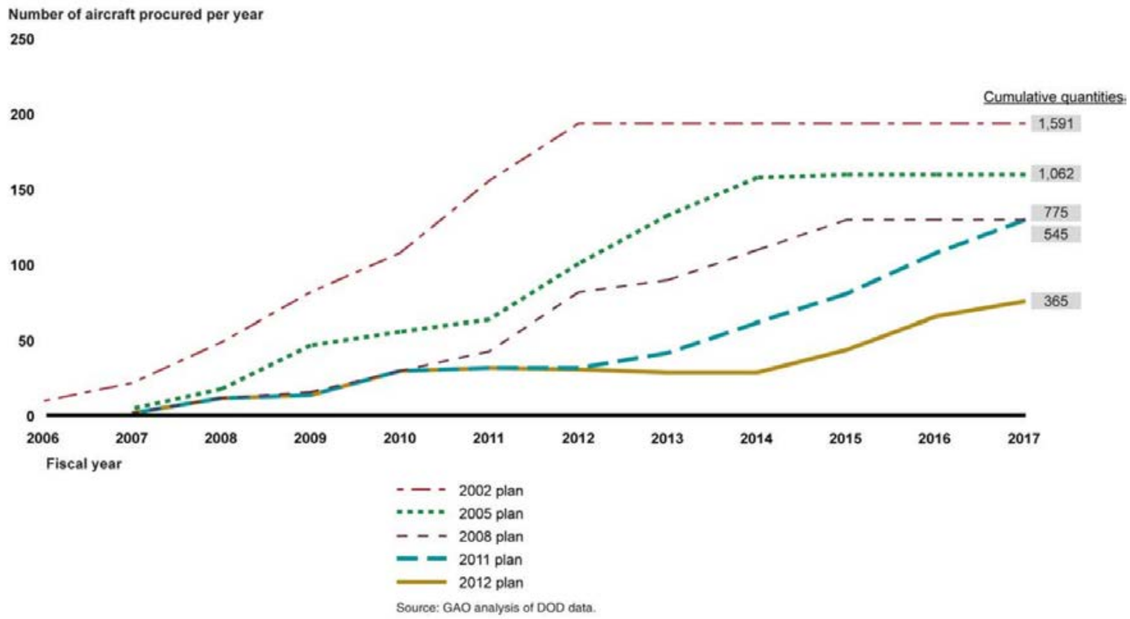

Figure 8. Changes in Procurement Plans over Time. Source: U.S. Government Accountability Office (2012).

After readjusting the cost and schedule baselines in 2012, DOD made more changes every following year. The number of aircraft to be bought between 2015 and 2017 was decreased by 37 by the DOD while the procurement timeline was extended another year. Then, in 2014, procurement of four more aircraft was postponed over the same timeline. DOD based its decisions mainly on budget constraints. It was expected that these changes would reduce concurrency and funding risks in the short run. Nevertheless, it is anticipated that the average unit cost per aircraft will increase as well as the funding liability (U.S. Government Accountability Office, 2015).

E. CURRENT STATUS OF THE JSF PROGRAM

In this section, the current status of the JSF program is explained in detail including figures for the cost, schedule and quantity as well as the current technical issues faced.

1. Current Status by Numbers

Although it seems that the estimated figures for the cost, schedule, and quantity had risen substantially between the 2001 and 2012 baselines of the program, the numbers were rather stable between 2012 and 2015 (see Table 5) (U.S. Government Accountability Office, 2016a). Planned procurement numbers as of 2016 are shown in Table 6.

Table 5. Changes in Procurement Plans between 2001–2015. Source: U.S. Government Accountability Office (2016a).

	October 2001 initial baseline	March 2012 latest baseline	December 2015 estimates	Change from 2001 to 2012	Change from 2012 to 2015
Expected quantities (number of aircraft)					
Developmental quantities	14	14	14	0%	0%
Procurement quantities	2,852	2,443	2,443	-14	0
Total quantities	**2,866**	**2,457**	**2,457**	**-14**	**0**
Cost estimates (then-year dollars in billions)[a]					
Development	$34.4	$55.2	$55.1	60%	-.18%
Procurement	196.6	335.7	319.1	71	-4.94
Military construction	2.0	4.8	4.8	140	0
Total program acquisition	**233.0**	**395.7**	**379**	**70**	**-4.22**
Unit cost estimates (then-year dollars in millions)a					
Program acquisition	$81	$161	$154	99	-4.35
Average procurement	69	137	130.6	99	-4.67
Estimated delivery and production dates					
Initial operational capability	2010-2012	Undetermined	2015-2018	undetermined	5-6 years
Full-rate production	2012	2019	2019	7 years	0 years

Table 6. Program of Record. Source: Lockheed Martin Corporation (2016).

USAF	1,763 F-35As
DoN (USN/USMC)	680 F-35B/Cs
U.K. RAF/RN	138 F-35Bs
Italy	60 F-35As/30 F-35Bs
Netherlands	37 F-35As
Turkey	100 F-35As
Australia	100 F-35As
Norway	52 F-35As
Denmark	27 F-35As
Canada	65 F-35As
Israel	33 F-35As
Japan	42 F-35As
S. Korea	40 F-35As

“Since 2011, a total of 154 aircraft have been delivered to DOD and international partners, 45 of which were delivered in 2015” (U.S. Government Accountability Office, 2016a). Figure 9 illustrates the aircraft delivered and in production.

Figure 9. Number of F-35 Joint Strike Fighter Aircraft Delivered and in Production as of December 2015. Source: U.S. Government Accountability Office (2016a).

DOD has divided its development, testing, and fielding activities into software blocks (U.S. Government Accountability Office, 2016a). Figure 10 shows these blocks, related capabilities brought by these blocks and the percentage of test points completed.

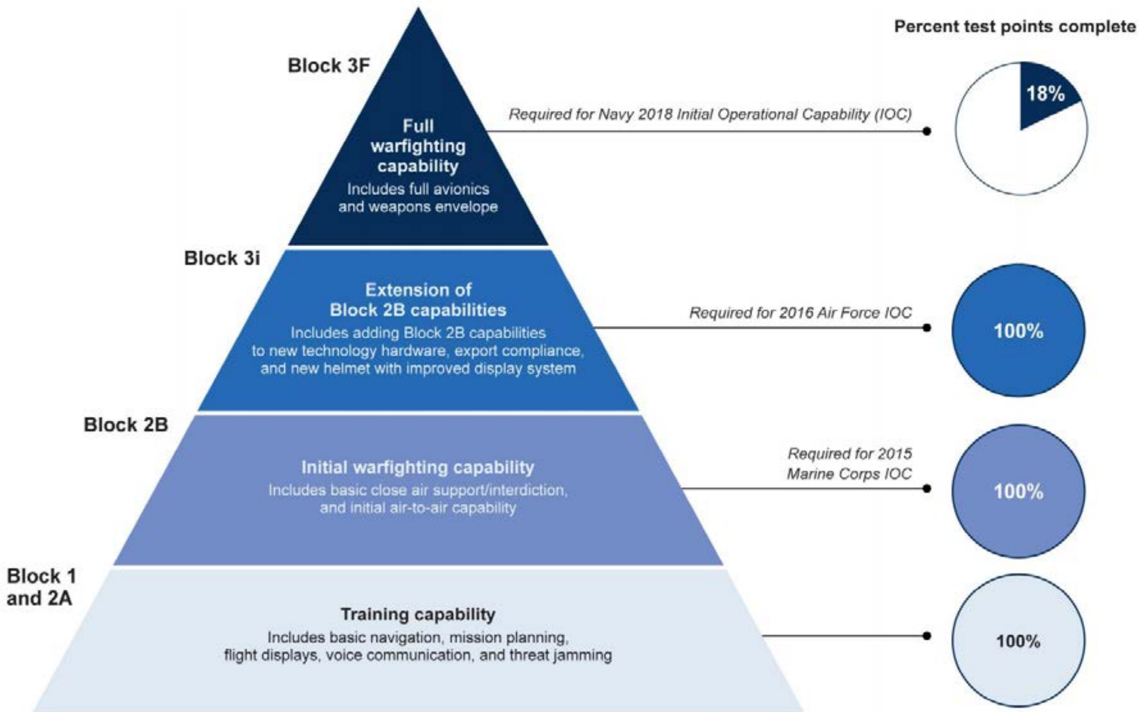

Figure 10. Subsequent Development and Flight Test Status of F-35 Joint Strike Fighter Mission Systems Software Blocks as of December 2015. Source: U.S. Government Accountability Office (2016b).

2. Current Technical Issues

The JSF program still has performance issues yet to be resolved. Some of the most significant technical issues are as follows:

(1) Engine Seal

In order to fix the engine overheating problem that occurred in 2014, a design change was proposed and implemented by the officials. After investigations, the officials determined that 180 engines needed that fix, and 69 of those aircraft received the new parts by September 2015. Pratt and Whitney undertook the retrofitting costs as the engine contractor (U.S. Government Accountability Office, 2016a).

(2) Ejection Seat

The program officials detected another problem regarding the ejection seats, which was the possibility of neck injuries during ejection for pilots weighing less than 136 lbs. The problem was caused by the rotation of the ejection seat together with the power of the parachute deployment. The issue was discovered while testing the helmet mounted display, yet it was not due to the helmet's weight. To solve this problem, the officials are considering implementing a switch for the pilots to allow them to slow down the parachute deployment, decreasing the helmet weight, or retrofitting a head rest to minimize the head movement during ejection. The final fixes and the cost of the fix are yet to be determined (U.S. Government Accountability Office, 2016a).

(3) Autonomic Logistics Information System (ALIS)

ALIS has several ongoing issues that pose schedule and operational risks. For instance, it may not be deployable. The Marine Corps usually deploys to harsh locations. On the other hand, ALIS requires necessary infrastructure to power the system and server connectivity. Even though the version was updated in 2015, the comprehensive deployability tests have not been completed. Another issue is that ALIS does not have a backup system or redundancy for the central point of entry and main operating unit, which can cause the fleet to go offline if the system fails (U.S. Government Accountability Office, 2016a).

(4) Wing Structure Cracks

In 2015, after completion of almost 85 percent (13,700 hours) of the required hours of durability testing, officials noticed cracks in the wing structure of the structural testing aircraft of the F-35C variant. The testing process was put on hold until the test aircraft was fixed and strengthened using internal and external straps. Lockheed Martin officials said that a long-term fix for the issue has not been found. Nevertheless, officials do not expect this problem to have significant impacts since the issue occurred beyond the lifecycle of the aircraft (U.S. Government Accountability Office, 2016a).

3. Summary

The F-35 development program is approaching the finish line; however, there are still many developmental flight tests to be accomplished. Although the majority of the problems encountered so far have been either resolved or lessened, the program still possesses risk elements. Some ongoing issues, including the performance problems with ALIS, the ejection seat, and the wing structures of the F-35C variant, are yet to be resolved. In addition, cost, affordability, and oversight issues are still expected to be encountered. For instance, DOD already foresees that starting in 2022, more than $14 billion each year will be needed for a decade in order to obtain aircraft. Considering its other programs, such as the C-46A tanker and the long-range strike bomber, competing for resources, it seems improbable for the DOD to keep up with the funding for the program over such a long period given that multiyear contracts already cover almost 30 percent of DOD’s acquisition budget (U.S. Government Accountability Office, 2016a).

IV. CONCEPTUAL MODELS OF GRAHAM T. ALLISON FOR FOREIGN POLICY ANALYSIS

Conceptual frameworks for understanding and explaining strategic decision making in organizations, especially military, and for foreign policy analysis have decades-long history. RAND Corporation was one of the first institutions that practiced interdisciplinary and organizational approach in studying nation's actions and decisions (Augier & Guo, 2012).

Andrew Marshall, a strategic thinker and a foreign policy strategist at RAND Corporation, starting in the 1960s, suggested that incorporating multiple studies on organizational behavior might bring a different perspective to strategic decision making. To further investigate organizational behavior in military organizations, Marshall brought together study groups including pioneers of the area such as Joe Bower, Richard Neustadt, Fred Ikle, Ernest May, Harry Rowen and Graham T. Allison, who was also the rapporteur (Augier & Guo, 2012).

Allison's involvement in these groups, in addition to his studies with Marshall, paved the way for his well-known book *Essence of Decision: Explaining the Cuban Missile Crisis* (1971). In the second edition, Allison, together with Philip Zelikow, broadened the scope of his book to include recent studies. They summarize their study in three propositions:

> 1. Professional analysts of foreign affairs and policymakers as well as ordinary citizens think about problems of foreign and military policy in terms of largely implicit conceptual models that have significant consequences for the content of their thought.
>
> 2. Most analysts explain and predict behavior of national governments in terms of one basic conceptual model here entitled Rational Actor Model.
>
> 3. Two alternative conceptual models, here labeled an organizational behavior model and a governmental politics model provide a base for improved explanations and predictions. (Allison & Zelikow, 1999)

A quick overview of the three models in their own words is included here:

> A central metaphor illuminates differences among these models. Foreign policy has often been compared to moves, sequences of moves, and games of chess. If one were limited to observations on a screen upon which moves in the chess game were projected without information as to how the pieces came to be moved, he would assume—as Model 1 does—that an individual chess player was moving the pieces with reference to plans and maneuvers toward the goal of winning the game. But a pattern of moves can be imagined that would lead the serious observer, after matching several games, to consider the hypothesis [Model 2] that the chess player was not a single individual but rather a loose alliance of semi-independent organizations, each of which moved its set of pieces according to standard operating procedures. For example, movement of separate sets of pieces might proceed in turn, each according to a routine, the king's rook, bishop, and their pawns repeatedly attacking the opponent according to a fixed plan. Furthermore, it is conceivable that the pattern of play [Model 3] would suggest to an observer that a number of distinct players, with distinct objectives but shared power over the pieces, were determining the moves as the resultant of collegial bargaining. For example, the black rook's move might contribute to the loss of a black knight with no comparable gain for the black team, but with the black rook becoming the principal guardian of the 'palace' on that side of the board. (Allison & Zelikow, 1999, p. 6)

In this chapter, these three models and the "path dependence" concept (David, 1994) are discussed briefly.

A. THE RATIONAL ACTOR MODEL (MODEL I)

The rational actor model (RAM) of Graham T. Allison and Philip Zelikow (1999) tries to elucidate international incidents and affairs by rechecking and evaluating the goals and calculations of governments or nations. Most foreign policy analysts and even citizens primarily apply this model in order to understand international events.

When we talk about international events, we regard them as policies or decisions rather than coincidental happenings. The terms "decision" and "policy" assume a decider and a number of choices to achieve a "goal" (Allison & Zelikow, 1999).

The assumption of goal-driven behavior is very prevalent in social sciences. For instance, in economics, a "rational" customer chooses the right number of products A, B, and C in order to maximize their utility. Similarly, a rational seller supplies the right

amount of a product at a point that maximizes his profit at which marginal revenue equals to marginal cost. In more uncertain areas, such as in game theory, decision makers try to maximize their expected utility.

There are four core concepts of rational action (Allison & Zelikow, 1999).

- Goals and Objectives: Payoff or utility or preferences are explained by a payoff function that ranks all possible consequences in terms of goals and objectives.

- Alternatives: The rational decision maker chooses from among a set of sufficiently differentiated alternative courses of action.

- Consequences: Each alternative has its own set of consequences and outcomes.

- Choice: The rational choice is to select the best alternative that ranks highest in the payoff function.

In this context, rationality means value-maximizing choice. Conscious rationality is the base assumption of “consumer theory” and “theory of the firm” in economics (Allison & Zelikow, 1999). If an analyst knows these four aspects of a decision maker, 1) he can calculate the most reasonable course of action for the decision maker to achieve his objectives, and 2) he can assume that this action will actually be chosen since the decision maker is rational.

This assumption of rationality may be as misleading as it is explanatory. In order to avoid misleading assumptions, an analyst should differentiate between “comprehensive rationality” and “bounded rationality” (Allison & Zelikow, 1999). In comprehensive rationality, the actor has all the information about alternatives, assesses all consequences, and has a utility function that ranks all the alternatives to make the value-maximizing choice. The actor is assumed to have full knowledge and computational power. The actors who misperceive a situation are defined as irrational. On the other hand, in bounded rationality, the content of the objectives, limitations of the knowledge, and the computational power of the actor are recognized. The model takes into account the values and beliefs of the actor, the information, and the perception he has of the situation.

On the other axis of the spectrum lies the information about the agent. When the analyst has the least information, the actor is a *notional state* (i.e., state A). As the amount of information increases with more specification and context, the agent becomes a *generic state* classified by a regime type (i.e., democracy), or with further information, an *identified state* (i.e., the United States). The agent is at the *personified state* if the leader puts his personal opinions, thoughts, and values to the center. (i.e., the Kennedy administration) (Allison & Zelikow, 1999).

The RAM is applied across the spectrum, which ranges from the least information (*notional state*) to the highest information (*personified state*) about the agent. This matrix is shown in Figure 11.

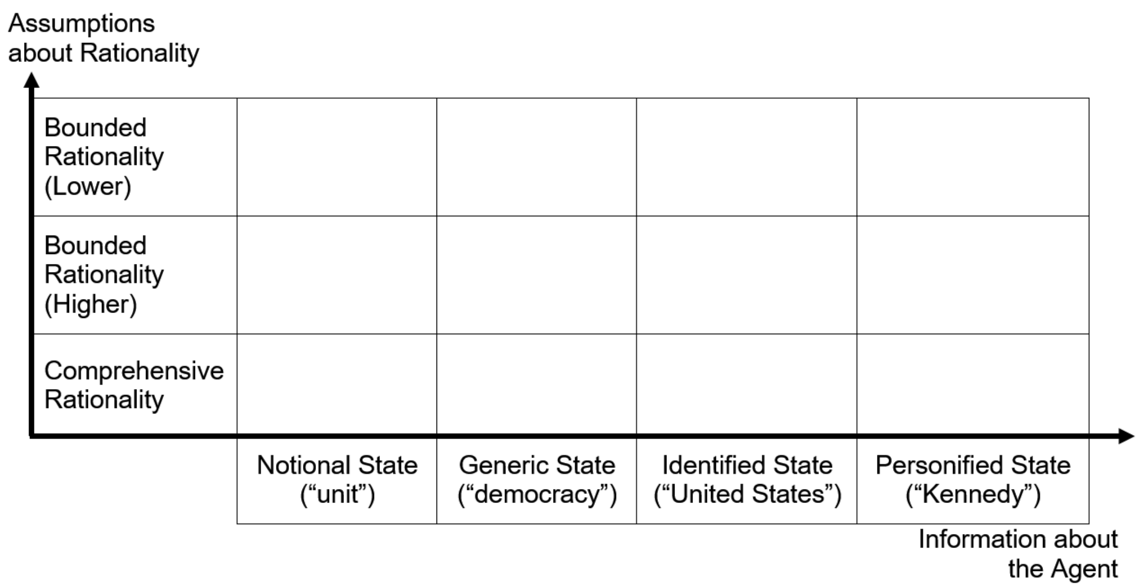

Figure 11. Application of the Rational Actor Model. Adapted from Allison & Zelikow (1999, p. 22).

We can formulate the RAM by the “analytical paradigm” developed by Robert K. Merton for sociological analyses. Merton suggests that “a paradigm is a systematic statement of the basic assumptions, concepts, and propositions employed by a school of analyses” (Allison & Zelikow, 1999, p. 23). The components of the paradigm that was used in Allison and Zelikow’s (1999, p. 24) study are as follows:

1. Basic Unit of Analysis

Governmental action as choice: International events are a result of national governments choosing the best option that will maximize their strategic goals and objectives.

2. Organizing Concepts

The organizing concepts that help to better understand the Rational Actor Model are briefly described in this section.

a. Unified Rational Actor

The government is the "agent" who is a rational, unitary decision maker.

b. The Problem

The agent acts in response to a strategic situation and arising threats and opportunities.

c. Action as a Rational Choice

(1) Objectives: National interests

(2) Alternatives: Options available

(3) Consequences: "Benefits and costs in terms of strategic goals and objectives"

(4) Choice: Value maximizing alternative (Allison & Zelikow, 1999, p. 24)

3. Dominant Inference Pattern

To accomplish the objectives of the actor, a nation or its representative performs a certain action. This action must have been chosen as the "value maximizing means" (Allison & Zelikow, 1999, p. 24). The model accepts the beliefs and values of the players regardless of their accuracy (bounded rationality) rather than classifying their action as irrational. The inference pattern provides the model its descriptive power.

4. General Prepositions

(1) We can formulate the general principle as the likelihood of any particular action depending on:

- The state’s relevant values and objectives
- Perceived alternative courses of action
- Estimates of consequences
- Net valuation of each set of consequences (Allison & Zelikow, 1999, p. 25)

(2) An increase (decrease) in the perceived costs of an alternative reduces (increases) the likelihood of that action being chosen (Allison & Zelikow, 1999, p. 25).

5. Evidence

Detailed behaviors, statements of government officials, and government papers provide a look through the government’s point of view.

6. The Advantages and Disadvantages of RAM

As Thomas C. Schelling noted, “A major advantage of the RAM is that you can sit in your armchair and try to predict how people will behave if you have your wits about you. You get, free of charge, a lot of vicarious, empirical behavior” (as cited in Allison & Zelikow, 1999, p. 49).

The disadvantage of this comfort is depending on only logical inferences and not knowing anything about the actual objectives, estimates, and options of the actor. An imaginative analyst can unintentionally come up with implausible objectives that he thinks the actor must have had. If an analyst makes further assumptions about an actor’s options and estimates, every RAM story is possible and consistent (Allison & Zelikow, 1999).

B. THE ORGANIZATIONAL BEHAVIOR MODEL

The organizational behavior model considers governmental actions as "outputs" of organizations that function according to a set of standard operating procedures, unlike the first model where actions were conscious "choices" (Allison & Zelikow, 1999). Therefore, with this second model, the analyst can comprehend governmental actions better, since the government is not an individual per se but comprises lightly allied organizations.

Allison (1999, p. 145) highlights five important aspects of an organization as follows:

- An organization is composed of elements that have diverse roles contributing to achievement of the goal of the entire system. The term "organization" in this model, is a formal, permanent establishment rather than temporary gatherings of people.
- The organization has a greater capacity than its members' individual capacity, thanks to division of labor and specialization.
- The organizations' behavior is limited by current routines and programs, and they are more inclined towards continuing what they are doing at the moment.
- Organizations' formal and informal norms provide a frame for the organizational culture to make individuals' behavior fit in.
- The capacity of an organization is defined by the "hardware," such as aircraft, pilots, whereas performance is determined by "software," such as standard operating procedures, routines.

The organizational behavior model is explained using the same components as defined in Allison and Zelikow's book (1999, p. 164) as follows:

1. Basic Unit of Analysis

Governmental action as organizational output is characterized by the following:

- Rather than the choices, the organizational outputs are the actual occurrences.
- The range of effective choice consists of existing organizational capacities and physical assets.

- Organizational outputs shape the situation and leaders mostly make decisions within the narrow constraints of the situation.

2. Organizing Concepts

The organizing concepts that help to better understand the Organizational Behavior Model are briefly described in this section.

a. Organizational Actors

The actor is a collection of loosely allied organizations rather than a monolithic nation.

b. Factored Problems and Fractionated Power

These are "the two edges of the same sword" (Allison & Zelikow, 1999, p. 167). Large governmental organizations have a considerable amount of autonomy over processing information and performing a set of actions. However, the large size of these organizations also prevents a single authority within the organization from making all important decisions.

c. Organizational Missions

Organizations, as well as businesses, have a clear and concise statement that expresses and explains the organization to its customers and members. Organizations interpret those missions according to their own terms.

d. Operational Objectives, Special Capacities, and Culture

Organizational culture and external bodies, such as clients, government allies, and extra-national counterparts, limit the view of an organization and result in organizations developing stable propensities. According to Allison and Zelikow (1999, p. 167), organizational culture is highlighted by the following characteristics:

- The way the organization has defined success in operational terms
- Selective information available to the organization
- Special systems or technologies operated by the organization

- Professional norms for recruitment and tenure of personnel
- The experience of making “street-level” decisions
- Distribution of rewards by the organization

e. Action as an Organizational Output

(1) Objectives: Compliance Defining Acceptable Performance

Allison and Zelikow (1999) suggest that the operational objectives of an organization are derived from a set of targets and constraints, which represents a quasi-resolution. The constraints are usually articulated by imperatives to avoid disasters and discomforts.

(2) Sequential Attention to Objectives

A different set of subunits, which are most concerned with the problem, deal with each problem. This sequential attention resolves the conflicts among operational targets and constraints.

(3) Standard Operating Procedures (SOP)

The standard rules about operation enable coordinated action by a large number of individuals. These rules are usually unambiguous and easy to learn. They do not change quickly or easily. The deeper the SOPs are grounded in the organization’s culture, the more resistant they are to change.

(4) Programs and Repertoires

A set of SOPs for producing specific actions comprise a program for handling a situation. Repertoires consist of programs related to a certain activity. These repertoires and programs become more important in determining the organizational behavior as the number of individuals included in the situation increases (Allison & Zelikow, 1999).

(5) Uncertainty Avoidance

Organizations tend to avoid uncertainty rather than to estimate the future possibilities. They try to maximize autonomy by a negotiated environment.

(6) Problem-directed Search

An organization's search for alternatives is problem oriented. It focuses on similar symptoms first, then the course of actions similar to the current alternative.

(7) Organizational Learning and Change

Learning and change usually happen within the world view of the organization's culture. However, dramatic changes occur sometimes under these conditions (Allison & Zelikow, 1999, p. 171):

- Budgetary Feast (i.e., Apollo Program budget during Cold War)
- Prolonged Budgetary Famine (i.e., budget cuts in the U.S. DOD)
- Dramatic Performance Failures (i.e., Challenger disaster)

f. Central Coordination and Control

The central coordination of foreign policy is necessary for the nation's welfare (Allison & Zelikow, 1999). Constraints are basic instruments of central control. However, the specification of effective operational constraints is difficult, especially for the organization whose outputs cannot be easily quantifiable. Organizational culture also makes it difficult for political leaders to intervene quickly and easily in those organizations.

g. Decisions of Government Leaders

In the long run, leaders can make deliberate changes in organizations or even create a new one. They mostly rely on an organization's existing programs, which includes information, estimates, and alternatives on a given issue.

3. Dominant Inference Pattern

"Assuming ***t*** is a specific point in time, the best explanation of an organization's behavior at ***t*** is its behavior at ***t-1***; the best prediction of what will happen at ***t+1*** is its behavior at ***t*** " (Allison & Zelikow, 1999, p. 175).

4. General Prepositions

General propositions for the Organizational Behavior Model listed by Allison and Zelikow (1999) are explained in this section.

a. Existing Organized Capabilities Influence Government Choice

A special existing capacity of an organization, which has already been paid, is more likely to be chosen because it is a conceivable option and available at a lower cost than a hypothetical option.

b. "Organizational Priorities Shape Organizational Implementation"

Organizations are hesitant when it comes to stating the goals that are most in line with their own capabilities and conceptions of duty. If the organization's goals are conflicting yet compatible with its culture and capacity, the choice is made regarding the incompatible constraints. The choice fulfils one of the conflicting goals and neglects the other. (Allison & Zelikow, 1999)

c. Implementation Reflects Previously Established Routines

Routines enable a large number of individuals within an organization to deal with standard situations successfully, without much thought, but not with specific, critical instances. Routines form SOPs, programs consist of complex set of programs, and repertoires comprises set of programs.

d. "Leaders Neglect Calculations of Administrative Feasibility at their Peril"

Allison and Zelikow (1999) assert that a considerable difference exists between the leaders' choices and the organizations' actual capability to implement those choices. Then there is another gap between what is chosen and what is actually implemented.

e. Limited Flexibility and Incremental Change

The behavior of an organization at time t, is slightly different than at t-1, therefore it is safe to predict that the behavior would also be similar at t+1. According to this

approach, organizations would take previous year's budget into account and change budgets incrementally. With the same logic, organizational procedures and repertoires would change incrementally as well. Moreover, any new activity would be a marginally adapted version of existing activities and programs. While the budgets, procedures and activities would be changed slightly and incrementally; organizational culture, priorities, and perceptions are most likely to stay the same.

An organization also demonstrates a consistent behavior. For instance, if a program is once initiated, it will not be terminated even when the estimated costs outweighs the benefits and negative outcomes are received. Instead, the organization would strengthen its commitment to the program even more by trying to rationalize including additional resources and not changing the course of action (Allison & Zelikow, 1999).

f. Long-range Planning

Model I assumes that governments deal with an uncertain future by long-run plans devised by planning units. Model II, on the other hand, assumes the effective contribution of those planning units to the organizational output.

g. Imperialism

Most organizations seek growth in their personnel, budget, new territory, and autonomy. Ambiguous and changing boundaries of these elements negatively affect the organizational output.

h. Directed Change

Changing main factors behind routines can lead to major changes in organizations. However, leaders' responsiveness to hot issues and short tenure make it difficult for them to manage the change.

5. Specific Prepositions

Specific prepositions for the Organizational Behavior Model defined by Allison and Zelikow (1999) are described in this section.

a. Deterrence

The probability of an outcome depends more on organizational factors than on balance and stability. For instance, in the case of the Cuban Nuclear Missile Crisis, organizational facts have more effect on the probability of a nuclear attack than superiority/inferiority of states' nuclear power. These facts can be investigated by five central questions:

- What is the control system of the enemy?
- What brings the enemy to alert status?
- What options will the leaders have when it is time to decide?
- What are the enemy's organizational procedures?
- What is the probability that organizational processes cause an accidental firing?

b. Force Posture

Routine functions of the organizational units shape the majority of the force posture (i.e., weapons and systems to be produced and deployed).

6. Evidence

Core information about the characteristics of the organizations that constitute a government and its routines should be available to analysts in order to generate a productive analysis. Even a minimum amount of such information can significantly improve the analysis and predictions generated by Model I.

7. Path Dependence Concept

Path dependence is another valuable concept in regards to organizational behavior for analyzing and explaining the international participation in the JSF program. In his study, Paul A. David (1994) draws a line between the "genealogical" method, which explains current features of economic arrangements by tracing their history, and the "teleological" method, which explains present aspects by analyzing functions and objectives. Most economists, however, use the former method when it comes to

analyzing institutions, except the economists who follow so-called “new institutional economics” that emerged during the 1970s.

David argues that even Douglass North, who supports the teleological method, started to use the genealogical method and quotes North: “Institutions evolve incrementally, connecting the past with the present and the future; …” (as cited in David, 1994, p. 207).

David (1994) uses the “path-dependence” phenomenon and equilibrium to describe the link between organizations and their history. He presents three major analytical findings to illuminate the path dependence of human organizations and understand why their history matters.

First, David (1994) emphasizes the role of shared history in having mutual expectations and achieving coordination among individuals without central direction. In so-called “pure” coordination games in which each option is equal in terms of gains, such as driving on the left or the right side of the road, “common knowledge” or shared history determines the outcome (i.e., left-hand traffic in former British colonies). The other source of mutual expectations is institutionalism. The range of actions of individuals in an institution is generally consistent since they are assigned to well-defined roles. These definitive roles, especially in comprehensive institutions such as the military, require new members to submit to the “acculturation” routines and accept the value of their roles in the organization; hence, the definition of the roles is a learned process.

Second, David (1994) suggests that organizations need channels for gathering and disseminating information. Once the organization establishes the channel, or the “code,” and the members learn how to use the code, it becomes irreversible and a sunk capital which the organization can only modify slowly over time. Therefore, the code of the organization shapes the behavior of the organization’s members.

Third, David (1994) emphasizes that compatible or complementary functions make the culture and the principles of the organization easier to understand, internalize, and communicate. Organizations consist of several functions that can be thought of as gears in a mechanical watch. The gears must be compatible with each other in order for

the watch to operate correctly and efficiently. David illustrates this analogy as the performance measurement/promotion function of an organization that should be consistent with the recruitment function; otherwise, it becomes complex and harder to implement. Therefore, the early established functions can later become constraints for the future functions, or “unintended results of historical development” that lock the organization in a comparatively narrow range of goals, options, and routines.

Finally, even though the conditions of path dependence in technological change are similar to microeconomic conditions that make institutions the carriers of history, it does not necessarily mean that technologies are just like institutions. Human organizations need to direct and channel the behaviors of individuals who are assigned to certain roles while pure technological systems do not include volitional actors. Information channels work more efficiently as they are used more intensively while machine organizations age and wear out from intensive use. The organizations require far greater knowledge to function than the technological systems do. This greater knowledge is also more prone to be lost due to higher risk of collapse of human organizations, take-overs, or layoffs (David, 1994).

An analysis from the organizational behavior point of view using these concepts and propositions can provide further insight for the JSF program and improve the predictions about the rationale behind Turkey’s decision.

C. THE GOVERNMENTAL POLITICS MODEL

In addition to the Rational Actor Model and the Organizational Behavior Model, Allison (1999, p. 255) proposed a third model: Governmental Politics. This model does not observe a single actor as Model I does or monolith organizations as Model II; however, it sees numerous players who have a role in national, organizational, and personal objectives.

In a game called ‘politics,’ the hierarchically positioned players, who are leaders of governmental organizations focusing on various intranational issues rather than a single problem, bargain along regularized circuits (Allison & Zelikow, 1999).

The governmental politics model is explained by using the same components as defined in Allison's book (1999, p. 294):

1. Basic Unit of Analysis

<u>Governmental action as political resultant:</u>

Compromise, conflict, and confusion of varied interests and uneven influences form the decisions and actions of governments.

Governmental actions are not only a combination of separate and independent decisions made by individuals and groups of players in several games, but also formal decisions of the government as well as its actions signify a mix of the players' choices and relative impacts.

2. Organizing Concepts

The organizing concepts that help to better understand the Governmental Politics Model are briefly described in this section.

a. Who Plays?

The actor is neither a collection of loosely allied organizations nor a monolithic nation, but rather a number of individual players.

b. "What Factors Shape players' Perceptions, Preferences and Stands on the Issue at Hand?"

(1) Parochial Priorities and Perceptions

The factors mentioned in Model II that boost the organizational parochialism have an impact on the players atop of the organizations as well. An analyst can make trustable predictions regarding a player's stand according to priorities arising from a position.

(2) Goals and Interests

Personal and organizations goals and interests can vary depending on the players' position, whereas domestic political interests are widely accepted.

(3) Stakes and Stands

Stakes can be defined as a mix of individual interests formed by the current issue. The player then takes a stand on the issue according to these stakes.

(4) Deadlines and Faces of Issues

Issues are raised and players are pushed to take stands due to deadlines and events. Surfacing of an issue usually results in the players' awareness of different faces of the issue. The face of an issue can be affected by the deadline for the decision and the channel in which the issue is raised.

c. "What Determines Each Player's Impact on Results?"

"Bargaining advantages, ability and will to use the bargaining advantages, and the other players' views on the first two" builds the political power. Authority and responsibility over information and resources are examples of the source of bargaining advantages (Allison & Zelikow, 1999, p. 300).

d. What Is the Game?

Three main components of the game are as follows:

(1) Action Channels

An action channel can be defined as a controlled way of taking governmental action on a specific type of issue. Preselection of key players, determination of the players' common points of entrance to the game, and division of certain advantages and disadvantages for every game are the factors forming the game (Allison & Zelikow, 1999).

(2) Rules of the Game

Rules are generated from constitution statutes, court interpretation, executive orders, conventions, and culture.

(3) Action as Political Resultant

Each player uses his or her power in a way that would result in advancing the player's conception of national organizational and personal interests.

3. Dominant Inference Pattern

The explanatory power of Model III is provided by displaying the game. This model attempts to identify the details of the game that led to victory. Model III tries to include misunderstandings, foul-ups, and the sharp differences between individuals' objectives and outcomes as well.

4. General Prepositions

General prepositions of Governmental Politics Model listed by Allison and Zelikow (1999) are as follows:

a. Political Resultants

1. Each individual player's own preferences and positions can substantially affect governmental action.
2. For every action-channel, the player's advantages and disadvantages differ significantly.
3. The advantages of each player or a mix of players show differences not only between action-channels but also along them.

b. Action and Intention

"Governmental action does not presuppose government intention. The resultant of behavior of representatives of a government relevant to an issue is rarely intended by any individual or single organization" (Allison & Zelikow, 1999, p. 306).

1. The players of the game have different perceptions of the issue and different preferences for how to solve the issue.
2. Actions are results of temporary agreements, not widely accepted principles.
3. The results of a number of games do not necessarily indicate a coordinated action or conscious signals.

c. Problems and Solutions

1. Since each player also has personal objectives, which the analyst does not know, behind his decisions, there is often a wide gap between what an analyst focuses on and a player focuses on.

2. Substantial change decisions in government are usually a concurrence of chief's issues seeking solutions and experts' solutions looking for a problem.

d. Stance and Seat

"Where you stand is significantly affected by where you sit" (Allison & Zelikow, 1999, p. 307). Organizational seat (i.e., the Secretary of Defense, the Chief of the Air Force) provides an analyst with important information about the stance organizational leaders take toward an issue.

e. Chiefs and Indians

In terms of policy making and implementation, the demands on the president, chiefs, staffers, and Indians are very different. The fight among the Indians of different departments resembles a microcosm of a higher-level action. However, the main issue for the Indians is getting the chiefs' attention.

In policy making:

> The issue looking down is options: how to preserve my leeway until uncertainties are clarified with time;
>
> The issue looking sideways is commitment: how to get others committed to my coalition;
>
> The issue looking upward is confidence: how to give the boss confidence to do what must be done. (Allison & Zelikow, 1999, p. 308)

f. The 51-49 Principle

The time the players think about policy choices and the way they defend their preferred choices are affected by the terms and conditions of the game. The players do not have much time to make important policy choices as an analyst has. The players who hesitate (50-50) are beaten by the ones who argue one side of the issue confidently (51-49).

g. International and Intranational Relations

It is possible for a nation to try to accomplish an international objective in the primary game by directly taking part in another nation's intranational (secondary) game. Thus, bargaining between domestic players can affect the international bargaining game between nations.

h. The Face of the Issue Differs From Seat to Seat

A function of the group choice process is to achieve a limited agreement on the face of the issue.

i. Misexpectation

It is inevitable in the lower priority games to assume someone will think about someone else in terms of how "he helps me with my problem" (Allison & Zelikow, 1999, p. 310).

j. Miscommunication

Accurate communications are hard to achieve when the speed and noise level are combined with tendencies of perception.

k. Reticence

Reticence, in other words hesitancy and discretion in sharing information, may come with advantages for the players involved in more than one game. This behavior could prevent affecting more important games negatively, allow others to make their own evaluations regarding to a certain situation, and reduce the possibility of any dispute between a chief and his or her subordinates as well.

l. Styles of Play

Bureaucratic careerists (civilian or military), lateral-entry types, and political appointees have differences in their behaviors. For instance, a bureaucrat should use a code of conformity to endure the changes of administration and personnel. On the other

hand, the lateral-entry type and the political appointee are usually temporary employees with short tenure thus they seek short-term achievements.

5. Specific Prepositions

Prepositions of the Governmental Politics Model, specific for the Cuban Missile Crisis are described by Allison and Zelikow (1999) as follows:

a. Use of Force in Crises

1. The president is highly unlikely to perform forceful action without firm support from other chiefs.
2. The individuals' opinion on an issue will be affected by their personality and the pressure of their position.
3. The outcome depends on how the problem was framed for action. For instance, if the action is framed as an incremental move, a forceful action is more probable.

b. Military Action

1. For a military action, not including a nuclear war, the decision and application will be on hold until the proponents convince the opponents to agree.
2. The decision to use military forces is, in general, not just presidential or majority decisions but rather a decision made by a large plurality.
3. A major military action would not be taken unless thorough consultations are carried out with the military players.

6. Evidence

Details of a government's perceptions and priorities on a specific issue can be gathered only after extensive studies. Documents themselves are usually resultants; therefore, they would not include extensive information about perceptions. The way to properly analyze an issue is to have a number of participants still with a fresh memory of what happened, which is highly unlikely.

D. SUMMARY

One of the questions that Allison and Zelikow try to answer in their well-known book, *Essence of Decision: Explaining the Cuban Missile Crisis* (1999), is “Why the United States blockaded Cuba?” According to an analyst who is using the Rational Actor Model, the question why seeks for the reasons that justifies the blockade as a response to the strategic issues that would result from existence of Soviet missiles in Cuba. On the other hand, for an analyst who uses the Organizational Behavior Model, the aim is to define such outputs of key organizations that resulted in a blockade. Finally, for a Governmental Politics Model analyst, the question why is for the political bargaining between the players with different interests, expectations, thoughts of actions and views.

In the next chapter, this conceptual framework helps to understand and explain why Turkey participated in the JSF program.

V. ANALYSIS OF THE JSF PROGRAM FROM TURKEY'S POINT OF VIEW USING CONCEPTUAL MODELS

In this chapter, Turkish participation in the JSF program is analyzed through two lenses: that of the Rational Actor Model (Model I) and the Organizational Behavior Model (Model II). The Governmental Politics Model is out of the scope of this study due to insufficient time to gather the required detailed information about government officials' decisions and preferences, and difficulty in gathering and using personal or non-public data.

A. TURKISH PARTICIPATION IN THE JSF PROGRAM THROUGH THE RATIONAL ACTOR MODEL

The explanatory power of the Model I stems from the convenience with which an analyst can use it without even stepping out of his or her office. In his book, Allison pictures a strategic analyst from Mars who could read newspapers to describe how far a detached analyst could go examining facts. Considering technological advancement since 1999, let us imagine the strategic analyst as a Martian who has internet access. He or she could easily—after a decent amount of reading and translation, of course—come up with the same hypotheses presented in this section.

1. Organizing Concepts

Before discussing hypotheses, it is important to identify the organizing factors of this model.

a. The Agent

Through a rational actor lens, the agent is a unified rational actor, an identified state: Turkey.

b. The Goals and Objectives

Turkey's main objectives for participating in the JSF program were 1) to replace aging fighter aircraft (F-5s, F-4s, and eventually F-16s) of the TuAF with a

technologically advanced, force multiplier combat aircraft; 2) to benefit from industrial participation as much as possible to improve its industrial base and increase its know-how; 3) to be able to access and change the software source codes for independent national operations and integration of indigenously designed smart munition; and 4) international prestige within its region (Güvenç & Yanık, 2012; Ozdemir, 2009). In light of these objectives, we can simply define Turkey's objective function as shown in Figure 12; with a, b, c, and d being the weight of importance of the criteria and the criteria being technology (T), local work-share (W), source code access (A), and international prestige (P).

T_n = technological superiority of alternative "n"
W_n = local work-share of alternative "n"
A_n = access to software source code of alternative "n"
P_n = international prestige of alternative "n"

a = weight of importance of criterion T
b = weight of importance of criterion W
c = weight of importance of criterion A
d = weight of importance of criterion P

Total value of alternative "n", $Z_n = a(T_n) + b(W_n) + c(A_n) + d(P_n)$

Objective function:
Choose the alternative with the highest Z value

Figure 12. Objective Function for Turkey's Decision

The same unit, such as millions ($), should be used to value each criterion for the consistency of the comparison.

c. The Alternatives

Turkey had two alternatives to replace its fighter aircraft: participation in the Joint Strike Fighter program or participation in the Eurofighter program. Even though Turkey participated in the early phases (CDP and SDD) of the JSF program, the Eurofighter group—Germany, Italy, Spain, and the United Kingdom—invited Turkey several times

to participate in the Eurofighter Typhoon program as an equal partner in 2006 (Ozdemir, 2009). Thus, the decision was which program to participate in and commit to buy a certain number of aircraft, rather than whether to participate in the JSF program or not.

d. The Action as a Rational Choice

The need to replace aging aircraft was inevitable for Turkey. Thus, the action was to choose the value maximizing alternative: in which cooperative aircraft acquisition program to participate to modernize the combat fleet of TuAF.

To examine the rationale behind the final choice of participation in the JSF program, we analyze each criterion as a separate hypothesis, which assumes the criterion in question was the most important factor in Turkey's decision-making process.

2. Hypothesis I: Technological Superiority

Despite the debates about the technological superiority of the F-35 over the Eurofighter in terms of kinematic performance, transonic acceleration, integrated sensors, beyond visual range and high angle-of-attack flight performance as well as stealth, the Eurofighter is considered as a 4.5 (or "4 plus") generation aircraft while the F-35 is a fifth-generation fighter (Cenciotti, 2013).

The U.S. government defines 4.5-generation fighter aircraft as "fighter aircraft that have advanced capabilities, including AESA radar, high capacity data-link, enhanced avionics, and the ability to deploy current and reasonably foreseeable advanced armaments" (O'Rourke, 2009b).

Assuming that technological superiority was the top concern for Turkey, with other conditions remaining the same, the F-35 would be a better value-maximizing choice due to its latest technology features. However, considering the technological superiority of Turkey's entire combat fleet over other countries in its region would be more rewarding than comparing the two aircraft types head to head.

Replacing old, fourth-generation aircraft that have high repair and maintenance, such as F-5s and F-4s, with a 4.5 generation aircraft, Eurofighter, as early as 2010 (TDN Defense Desk, 2006) might have been a more valuable option than procuring 30

additional Block50+ F-16s due to delays in the JSF program, given that Turkey is still waiting for the delivery of its first batch of two F-35As in 2018 (Sariibrahimoglu, 2016).

In October 2006, Turkey announced that 30 F-16 Block50+ would be procured as a stopgap measure against potential delays of the JSF program (Güvenç & Yanık, 2012). In December 2008, TAI and the prime contractor, Lockheed Martin, signed a letter of agreement for the assembly and flight operations of the new batch of 30 F-16 Block50+. All 30 aircraft were delivered by December 2012 (Turkish Aerospace Industries, n.d.a; 2012).

On the flip side, the Turkish aviation industry, primarily TAI, benefited from the additional F-16 procurement since the final assembly and flight test were performed by TAI as a subcontractor of the prime contractor. In addition, TuAF had been operating F-16s since 1987 (Bekdil, 1999) and established its operation and maintenance routines while the Eurofighter would have introduced a whole new acquisition, operation, and maintenance routine and procedures.

In the light of these facts, since they mostly favor the JSF program, technological superiority might be the primary objective for Turkey in the decision process.

3. Hypothesis II: Local Work-Share

Another major concern for Turkey was local work-share. Although the work-share decision was made on a best-value basis, meaning that companies from different partner countries competed against each other for subcontracts in the JSF program, Turkey's goal was to secure enough local work-share to equal at least 50 percent of the total acquisition costs (Güvenç & Yanık, 2012).

Turkey participated in the SDD phase of the JSF program but was not offered a guaranteed local work-share. On the other hand, the Eurofighter consortium proposed to Turkey a total of $9 billion local work-share in return for an order of 120 aircraft, $6.2 billion for 80 aircraft, and $3 billion for 40 aircraft (TDN Defense Desk, 2006). Turkey used this offer as a kind of leverage in negotiations with the JSF consortium, and by the

time Turkey signed the MOU in January 2007, Turkey had already secured a work-share worth $4.2 billion (Güvenç & Yanık, 2012).

By the time of the choice, in terms of work-share, the offer of the Eurofighter consortium, a guaranteed $9 billion, was more favorable than an uncertain amount that would be determined by the JSF consortium’s best-value principle. If the top priority had been local work-share, the Eurofighter might have been a more value-maximizing choice.

4. Hypothesis III: Access to Source Codes

The third concern of Turkey about its next-generation fighter was the ability to access and change the source codes to operate national operations and use indigenously designed munitions. In 2006, the Eurofighter consortium offered full access to source codes of the aircraft along with the full partnership (TDN Defense Desk, 2006). On the flip side, the main customer of the JSF, the United States, still refuses to give source codes to partner countries.

Turkey experienced a similar issue with the F-16s but was able to get access to source codes of F-16s in 2011, 24 years after the aircraft entered service in TuAF. Turkey used its dissatisfaction about lack of access to the source codes as leverage by putting the first JSF order in 2011 (Güvenç & Yanık, 2012).

The ability to access and change the source codes directly affects a nation’s independent operational capability. Based solely on the requirement for source code access, the Eurofighter, with a full access, might have been a more rational choice than the JSF, which is a closed box.

5. Hypothesis IV: International Prestige

Eurofighter customers include four consortium member states, the U.K., Germany, Italy, and Spain, and three customers outside the consortium, Austria, Saudi Arabia, and Oman.

On the other hand, in addition to its technological superiority, by 2022, the JSF will have been operated by 12 countries across the globe, including nine partners (two of which are also Eurofighter customers), Australia, Canada, Denmark, Italy, Netherlands,

Norway, Turkey, the U.K., the United States, and three as foreign military sales, Israel, Japan, and Republic of Korea (see Figure 13).

Figure 13. Countries that Will Be Operating JSF by 2022. Source: Lockheed Martin Corporation (Retrieved: October 27, 2016).

With its advanced technology and the power of ally operators, the JSF would be a more value-maximizing choice for Turkey, in terms of international prestige, since it would also be in accordance with TuAF's mission of being a deterrent force among its region.

B. TURKISH PARTICIPATION IN THE JSF PROGRAM THROUGH AN ORGANIZATIONAL BEHAVIOR MODEL

The Rational Actor Model is a fast and useful way to analyze government actions since it provides the convenience of assuming actors as individuals or a monolithic nation, determining possible alternatives, and ranking them according to their satisfactoriness level for the predetermined objectives. Typically, the actors are a combination of loosely allied organizations with their own unique objectives, routines, capabilities, and culture. Moreover, an analyst can explain the action in further detail by defining it as an organizational output rather than a rational choice.

1. Organizing Concepts

The most important organizing factors are discussed in the following subsections similar to the way the Rational Actor Model does.

a. The Agent

The actor is a collection of loosely allied organizations rather than a monolithic nation. In this case, participation in a joint fighter program in order to replace existing aging aircraft largely falls into the domain of the Turkish Ministry of National Defense, more specifically, the Undersecretariat for Defence Industries (UDI), TuAF, and the companies of the Turkish defense industrial base.

b. Organizational Missions

The mission of the UDI is the "management of industrialization, technology, and procurement programs that assures the continuous improvement of Turkey's defense and security capabilities" (Undersecretariat for Defence Industries, n.d.).

The main mission of TuAF is "to deter the enemy from its aggressive intention via its arms and means with superior velocity and brisance, to counteract enemy aircraft rapidly as soon as they enter Turkish airspace in case of an attack against the country, to discourage and dishearten from maintaining the war by destroying the vital military targets of the enemy country, and to ensure that war is won within the shortest time possible with least casualties" (Turkish Air Force, n.d.a).

As a major company of the Turkish defense industrial base and a subcontractor of the JSF Program, the main mission of TAI is "to lead the development of Turkey's aerospace industry" (Turkish Aerospace Industries, Inc., n.d.c).

c. Operational Objectives, Special Capacities, and Culture

Each major organization involved in the JSF program has its own operational objectives and special capabilities for the program. The Turkish UDI, as the acquisition authority, aims to acquire an affordable and sustainable weapon system while delivering

warfighters a force enabler capability and providing local work-share for defense companies.

The objective of TuAF, as a user, is to gain and operate a special capability—a new combat aircraft—in order to be "an air and space force, effective on its continent and leader in its region" (Turkish Air Force, 2013).

The goal of TAI, as a profit-seeking company, can be summarized as profit, growth, and increased know-how gained from the program.

The oldest and the largest of these major organizations is TuAF. Thus, the organizational culture of TuAF is further analyzed in the section "Organizational Culture of Turkish Air Force" in order to illustrate two of the important organizational aspects that Allison and Zelikow (1999, p. 167) suggest:

- Special systems or technologies operated by the organization
- Professional norms for recruitment and tenure of personnel

d. The Action as an Organizational Output

According to the Organizational Behavior Model, rather than being a value-maximizing choice, Turkish participation in the JSF program is an organizational output largely derived from "objectives," "sequential attention to objectives," "SOPs, programs, and repertoires" of the organizations constituting the government (Allison & Zelikow, 1999).

2. Organizational Culture of Turkish Air Force

The primary operation of TuAF is to fly its aircraft for air superiority, combat, training, combat search and rescue, and military transportation. All other functions, from recruiting to construction, from acquisition to decommissioning of aircraft, from logistics to health and safety services, are established to support this very function.

As a result of this main function, the leadership of TuAF, by its nature, has been dominated by pilots, especially fighter pilots. Each and every commander of TuAF between 1995 and 2015 was a jet pilot (see Table 7). Eighty percent of the commanders

were assigned to at least one NATO position, while 50 percent of them were assigned to a position or training in the United States throughout their career.

Table 7. Background Information about Commanders of Turkish Air Force between 1995 and 2015. Adapted from Turkish Air Force (n.d.c).

#	Term of Office	Jet Pilot	NATO Assignment	US Assignment
30th	2013 – 2015	Yes	Operation Deny Flight	-
29th	2011 – 2013	Yes	NAPMA[a]	Air Command and Staff College
28th	2009 – 2011	Yes	-	-
27th	2007 – 2009	Yes	AIRSOUTH HQ[b]	Air Command and Staff College
26th	2005 – 2007	Yes	AIRSOUTH HQ[b]	Air Command and Staff College
25th	2003 – 2005	Yes	6th Allied Tactical Air Force	Washington Military Attaché
24th	2001 – 2003	Yes	-	-
23rd	1999 – 2001	Yes	AIRSOUTH HQ[b]; Military Representative	Pilot Training
22nd	1997 – 1999	Yes	AIRSOUTH HQ[b]	-
21st	1995 – 1997	Yes	AIRSOUTH HQ[b]; 6th Allied Tactical Air Force	-

[a] NAPMA: NATO AEW&C Program Management Agency

[b] HQ: Headquarters

Moreover, as mentioned in Chapter III in detail, all of the fighter aircraft that Turkish fighter pilots flown since 1952 were USAF-based aircraft. Not only pilots, but also ground support personnel from logisticians to technicians, who procure, operate, and maintain these aircraft and support their flights have been accustomed to USAF-based standard/emergency operating procedures, manuals, and routines.

Another aspect of path dependency between the USAF and TuAF is shared history. According to a RAND study (Larson et al., 2004), Turkey is the third most frequent partner of the United States, having participated in 23 coalition operations, seven of which are United Nations operations, after the United Kingdom (29) and France (28).

Turkey and the United States became partners in training and education as an expected consequence of acquisition of USAF-based aircraft for over 50 years. USAF has been the major training partner of TuAF not only for pilots, but also maintenance, supply,

engineering, education, avionics, and navigation personnel. As shown in Table 8, the U.S. maintains the second-largest International Military Education and Training program with Turkish Armed Forces (Pawlyk, 2016).

Table 8. Top Five International Military Education and Training Programs of the United States by Fiscal Year 2015. Adapted from U.S. Department of State (n.d.).

Budget by Year - International Military Education and Training							
$ in Thousands for All Items	FY 2009 Actual	FY 2010 Actual	FY 2011 Actual	FY 2012 Actual	FY 2013 Actual	FY 2014 Estimate	FY 2015 Request
TOTAL	**93,000**	**108,000**	**105,788**	**105,788**	**99,197**	**105,573**	**107,474**
Pakistan	2,261	5,000	4,055	4,868	5,000	5,000	4,800
Turkey	**3,208**	**4,992**	**3,990**	**3,839**	**3,415**	**3,300**	**3,300**
Jordan	3,109	3,772	3,760	3,650	3,608	3,800	3,800
Lebanon	2,278	2,500	2,476	2,372	2,849	2,250	2,250
Tunisia	1,700	1,945	1,950	1,837	2,155	2,300	2,000

Despite the influence of the United States and USAF-based aircraft, Turkey also participates in European consortiums. In 1984, eight European countries, including Turkey, set up the Future Large Aircraft Exploratory Group to find a solution to the perceived capability gap of European military air transport fleets. In 2000, the group chose the proposal of the Airbus Military Corporation, A400M, over Ukrainian and American options mostly due to industrial and financial aspects rather than technical ones (Joana & Smith, 2006). The first aircraft was successfully delivered to TuAF on May 12, 2014 (Özen & Akyıl, 2014). As of 2016, the first three TuAF A400Ms of a total order of ten have been delivered (Undersecretariat for Defence Industries, 2015).

If Turkey had selected the Eurofighter over the JSF to replace the aging fighter aircraft of TuAF, the Eurofighter would not have been the first European military aircraft procured by Turkey, but it would have been the first European-based jet fighter of TuAF.

The influence of USAF-based combat aircraft, fighter pilots, NATO missions, and U.S. education and training programs on TuAF culture has persisted since 1950s. The JSF program will be another rivet to strengthen the links.

3. Other Organizational Factors

TAI is another major organization effective in the JSF program. Even though foreign shares of TAI were acquired by Turkish shareholders in 2005 (Turkish Aerospace Industries, Inc., n.d.c), TAI had been a joint venture between TUSAŞ and Lockheed Martin. The personnel of TAI have been proud of successful assembly and delivery of more than 300 F-16s as well as other modernizations of Lockheed Martin F-16s and C-130s since the foundation (Turkish Aerospace Industries, Inc., n.d.b).

The shared history between Lockheed Martin and TAI, similar to the one between TuAF and the USAF, might have played an important role in the selection process of Turkey's new generation fighter acquisition.

As David suggests (1994), early established "codes" in an organization can become constraints in the future. In the JSF case, one of the early establishments, Turkey's membership in NATO, might have ruled out other options, such as the Russian Sukhoi PAK FA T-50 and Chinese Chengdu J-20 and Shenyang J-31, even from the beginning of the capability requirement, which can be considered as an output of SOPs and routines in a huge organization like NATO, consisting of 28 countries.

Another huge organization, the European Union (EU) might have affected the fate of Turkey's participation in the Eurofighter program. Turkey applied to accede to the EU in 1987 and has been a candidate for full membership since December 11, 1999 ("Turkey–EU relations," n.d.). The European Council decided not to open eight chapters out of 13 chapters in 2006. In 2007, France declared that it would not allow five chapters to open, including one previously blocked by the European Council ("Turkey–EU relations," n.d.). This decline in Turkey-EU negotiations coincided with Turkey's decision to proceed with the JSF program despite the Eurofighter consortium's offer of full partnership and $9 billion worth of local work-share (Güvenç & Yanık, 2012).

C. SUMMARY

From a rational actor point of view, technological superiority and international prestige criteria favored the decision to participate in the JSF program while local work-share and source code access favored the Eurofighter program. A risk-averse rational actor would have chosen participation in the Eurofighter program because of the JSF's higher uncertainty of work-share and software access as well as its overruns in costs and delivery schedule. However, Turkey, supposing that its industrial base would manage to secure sufficient competitive contracts and the long partnership with the United States since 1950s would eventually result in an access to the source codes, chose the JSF over the Eurofighter.

From an organizational behavior point of view, the organizations that affected Turkey's decision to participate in the JSF program varies from huge organizations, such as NATO and the EU, to domestic aerospace companies such as TAI and TEI. The shared history and path dependence between those Turkish organizations and their foreign counterparts might have paved the way for Turkey's involvement in F-35 acquisition as well as their SOPs and routines in effect.

VI. CONCLUSION AND SUGGESTIONS FOR FUTURE RESEARCH

This chapter provides a summary and conclusion in regards to Turkish participation in the JSF program.

A. CONCLUSION

The Joint Strike Fighter (JSF), with its total cost of nearly $400 billion, is the largest and the most expensive development and acquisition program in history, with eight cost-sharing participant countries, which are the United Kingdom, Italy, Netherlands, Turkey, Canada, Australia, Denmark, Norway (Sullivan, 2016).

The main objective of the program is to develop and produce the fifth-generation, stealth, multi-role fighter that will replace aging fighter, strike, and ground attack aircraft for the United States Navy, Air Force, Marine Corps, and eight allies (U.S. Government Accountability Office, 2000).

Turkey, one of the participant countries of the JSF program, established the foundation of Turkish aviation in 1911 (Turkish Air Force, n.d.b), only eight years after the first flight of the Wright Brothers in 1903. During the 1920s and 1930s, Turkey was one of the few nations that had indigenous aircraft designs and production. After World War II, Turkey started to receive military assistance from the United States under the Truman Doctrine, which provided a tremendous improvement for the TuAF aircraft inventory while the fledgling Turkish aviation industry became redundant and did not stand a chance against low-priced military aid aircraft (Güvenç & Yanık, 2012). In 1952, Turkey's membership to NATO also introduced the first jet fighters to TuAF's fleet. Since then, TuAF has acquired and operated only USAF-based fighter aircraft (Karaağaç, 2010). The F-35A, the USAF and export variant of the JSF, will be the last ring of this chain.

The JSF program is unprecedented not only for its scope and costs, but also for the early participation of the partners in the development process. Six partners participated in the Concept Demonstration Phase on three different levels; the United

Kingdom as the only Full Collaborative Partner; Netherlands, Norway, and Denmark as Associate Partners; and Italy and Canada as Informed Partners (Birkler et al., 2001). Turkey participated in this phase as a Foreign Military Sales Major Participant, with a $6.2 million contribution (Birkler et al., 2001).

During the next phase, the System Development and Demonstration Phase, the foreign participant nations were assigned to one of three levels based on the amount they financially contributed. Turkey participated as a Level III partner with a contribution of $175 million (Bolkcom & Murch, 2007).

Unlike the previous phases, in the Production, Sustainment, and Follow-On Development Phase, there are no levels of participation and costs are divided between the participants in proportion to each partner's planned purchase amount. Turkey plans to buy 100 F-35As and ordered six F-35As (two in LRIP-10 and four in LRIP-11) as of 2016 (Undersecretariat for Defence Industries, 2016).

Interdisciplinary studies generally provide senior decision makers more value and insight than single aspect analyses, such as financial analysis of the JSF program. This study tries to facilitate different disciplines under a Master of Business Administration (MBA). Such disciplines include acquisition management, financial management, business modeling, strategic management, and foreign policy. Graham T. Allison's conceptual models happen to be a useful tool for such multidisciplinary and multidimensional analysis.

Graham T. Allison and Philip Zelikow (1999) suggest three conceptual models for foreign policy analysis. Model I, the Rational Actor Model, tries to explain the actions of a government assuming that it is a unified rational actor who is trying to make value-maximizing decisions according to available alternatives and existing objectives. Model II, the Organizational Behavior Model, supposes that the actor is a set of loosely allied organizations and the behaviors of these organizations, in conformance to their routines, standard operating procedures, and culture shortly their "codes," shape the output. Model III, the Governmental Politics Model, suggests that the action is a result of political

games, in which positional and personal goals and interests are in play, and the bargaining among the "players," the government leaders.

Foreign policy analysts, as well as ordinary people, consciously or unconsciously, use the Rational Actor Model in everyday life to understand and explain international events and governmental actions. The explanatory power of the model stems from empirical predictions that can be made from an office chair—thanks to the internet—just by gathering public information about an issue. However, without any information about an actor's actual objectives, estimates, and alternatives, an imaginative analyst can unintentionally come up with implausible objectives and conclude any story as consistent and possible. Model II requires more information than the first model, information about the history, routines, standard operating procedures, and culture of the organizations that form the governmental actor. This model provides more conceivable explanations and insight, especially for the actions considered irrational from a rational actor point of view. Model III requires even more information than the second model, information about personal and positional goals and interests of government leaders. In most cases, an analyst who manages to gather such information from one side to conduct a Model III analysis can only access sufficient information about the other side to conduct a Model I analysis, since a Model III analysis requires personal interviews, memoirs, and diaries. Accessing such sources gets harder each day after the event.

In this study, Turkey's decision to participate in the JSF program, especially in the Production, Sustainment, and Follow-On Development Phase, is analyzed through the Rational Actor and Organizational Behavior Models. From a rational actor point of view, publicly available information shows that Turkey had four major objectives in the acquisition of a next-generation multi-role combat aircraft. The JSF program is a more rational alternative in terms of technological superiority and international prestige while the Eurofighter option is more value-maximizing in terms of local work-share and access to source codes. Since the actual priorities and weight put on each criterion by the decision makers are unknown, the first model cannot conclude the participation decision either as rational or irrational. Model II turns out to be useful at this point. With further detail about the history, routines, standard operating procedures, and culture of the major

organizations that played a role in the decision process, the Organizational Behavior Model provides more insight. Turkey's history of partnership with the United States, especially the USAF'S and TuAF's shared history since 1952, the common combat aircraft and their routines, SOPs, and the partnership between the American prime contractor, Lockheed Martin and Turkish aerospace company, TAI, since 1980s, help to understand and explain the preference for the JSF program over the Eurofighter consortium. In addition to these strong signs of path dependency, TuAF's fighter pilot dominated culture might have played a role in this organizational output.

The Governmental Politics Model is kept out of the scope due to the constraints in gathering and using personal or non-public data and the time to gather the required detailed information about the objectives and preferences of the government officials and corporate leaders.

B. SUGGESTIONS FOR FUTURE RESEARCH

This MBA project analyzes Turkish participation in the JSF program with only two of the three models of Graham T. Allison. A look through the third lens, the Governmental Politics Model, would provide a greater understanding and an interesting angle regarding Turkey's decision to participate in the JSF program.

Second, further research about other JSF partner nations using the same models could offer an opportunity to compare how the objectives and actions of states, organizations, and governmental leaders differ due to rational estimates, organizational culture, and personal/positional interests.

Third, additional research might analyze the decisions of the partners of the Eurofighter consortium, especially the ones that also participate in the JSF program: the United Kingdom and Italy. Such research could reveal both sides of the story.

Last, but not least, this study might inform future research on plans of current participants or prospective buyers of the JSF program by providing a guide for applying conceptual models to joint acquisition programs, a point of reference and an opportunity for comparison.

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